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SOLUBILITY DATA SERIES

Volume 4

ARGON

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Volume 4

ARGON

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FOREWORD

If the knowledge is
undigested or simply wrong,
more is not better

How to communicate and disseminate numerical data effectively in chemical science and technology has been a problem of serious and growing concern to IUPAC, the International Union of Pure and Applied Chemistry, for the last two decades. The steadily expanding volume of numerical information, the formulation of new interdisciplinary areas in which chemistry is a partner, and the links between these and existing traditional subdisciplines in chemistry, along with an increasing number of users, have been considered as urgent aspects of the information problem in general, and of the numerical data problem in particular.

Among the several numerical data projects initiated and operated by various IUPAC commissions, the *Solubility Data Project* is probably one of the most ambitious ones. It is concerned with preparing a comprehensive critical compilation of data on solubilities in all physical systems, of gases, liquids and solids. Both the basic and applied branches of almost all scientific disciplines require a knowledge of solubilities as a function of solvent, temperature and pressure. Solubility data are basic to the fundamental understanding of processes relevant to agronomy, biology, chemistry, geology and oceanography, medicine and pharmacology, and metallurgy and materials science. Knowledge of solubility is very frequently of great importance to such diverse practical applications as drug dosage and drug solubility in biological fluids, anesthesiology, corrosion by dissolution of metals, properties of glasses, ceramics, concretes and coatings, phase relations in the formation of minerals and alloys, the deposits of minerals and radioactive fission products from ocean waters, the composition of ground waters, and the requirements of oxygen and other gases in life support systems.

The widespread relevance of solubility data to many branches and disciplines of science, medicine, technology and engineering, and the difficulty of recovering solubility data from the literature, lead to the proliferation of published data in an ever increasing number of scientific and technical primary sources. The sheer volume of data has overcome the capacity of the classical secondary and tertiary services to respond effectively.

While the proportion of secondary services of the review article type is generally increasing due to the rapid growth of all forms of primary literature, the review articles become more limited in scope, more specialized. The disturbing phenomenon is that in some disciplines, certainly in chemistry, authors are reluctant to treat even those limited-in-scope reviews exhaustively. There is a trend to preselect the literature, sometimes under the pretext of reducing it to manageable size. The crucial problem with such preselection - as far as numerical data are concerned - is that there is no indication as to whether the material was excluded by design or by a less than thorough literature search. We are equally concerned that most current secondary sources, critical in character as they may be, give scant attention to numerical data.

On the other hand, tertiary sources - handbooks, reference books, and other tabulated and graphical compilations - as they exist today, are comprehensive but, as a rule, uncritical. They usually attempt to cover whole disciplines, thus obviously are superficial in treatment. Since they command a wide market, we believe that their service to advancement of science is at least questionable. Additionally, the change which is taking place in the generation of new and diversified numerical data, and the rate at which this is done, is not reflected in an increased third-level service. The emergence of new tertiary literature sources does not parallel the shift that has occurred in the primary literature.

With the status of current secondary and tertiary services being as briefly stated above, the innovative approach of the *Solubility Data Project* is that its compilation and critical evaluation work involve consolidation and reprocessing services when both activities are based on intellectual and scholarly reworking of information from primary sources. It comprises compact compilation, rationalization and simplification, and the fitting of isolated numerical data into a critically evaluated general framework.

The *Solubility Data Project* has developed a mechanism which involves a number of innovations in exploiting the literature fully, and which contains new elements of a more imaginative approach for transfer of reliable information from primary to secondary/tertiary sources. *The fundamental trend of the Solubility Data Project is toward integration of secondary and tertiary services with the objective of producing in-depth critical analysis and evaluation which are characteristic to secondary services, in a scope as broad as conventional tertiary services.*

Fundamental to the philosophy of the project is the recognition that the basic element of strength is the active participation of career scientists in it. Consolidating primary data, producing a truly critically-evaluated set of numerical data, and synthesizing data in a meaningful relationship are demands considered worthy of the efforts of top scientists. Career scientists, who themselves contribute to science by their involvement in active scientific research, are the backbone of the project. The scholarly work is commissioned to recognized authorities, involving a process of careful selection in the best tradition of IUPAC. This selection in turn is the key to the quality of the output. These top experts are expected to view their specific topics dispassionately, paying equal attention to their own contributions and to those of their peers. They digest literature data into a coherent story by weeding out what is wrong from what is believed to be right. To fulfill this task, the evaluator must cover *all* relevant open literature. No reference is excluded by design and every effort is made to detect every bit of relevant primary source. Poor quality or wrong data are mentioned and explicitly disqualified as such. In fact, it is only when the reliable data are presented alongside the unreliable data that proper justice can be done. The user is bound to have incomparably more confidence in a succinct evaluative commentary and a comprehensive review with a complete bibliography to both good and poor data.

It is the standard practice that any given solute-solvent system consists of two essential parts: I. Critical Evaluation and Recommended Values, and II. Compiled Data Sheets.

The Critical Evaluation part gives the following information:

(i) a verbal text of evaluation which discusses the numerical solubility information appearing in the primary sources located in the literature. The evaluation text concerns primarily the quality of data after consideration of the purity of the materials and their characterization, the experimental method employed and the uncertainties in control of physical parameters, the reproducibility of the data, the agreement of the worker's results on accepted test systems with standard values, and finally, the fitting of data, with suitable statistical tests, to mathematical functions;

(ii) a set of recommended numerical data. Whenever possible, the set of recommended data includes weighted average and standard deviations, and a set of smoothing equations derived from the experimental data endorsed by the evaluator;

(iii) a graphical plot of recommended data.

The compilation part consists of data sheets of the best experimental data in the primary literature. Generally speaking, such independent data sheets are given only to the best and endorsed data covering the known range of experimental parameters. Data sheets based on primary sources where the data are of a lower precision are given only when no better data are available. Experimental data with a precision poorer than considered acceptable are reproduced in the form of data sheets when they are the only known data for a particular system. Such data are considered to be still suitable for some applications, and their presence in the compilation should alert researchers to areas that need more work.

The typical data sheet carries the following information:

(i) components - definition of the system - their names, formulas and Chemical Abstracts registry numbers;

(ii) reference to the primary source where the numerical information is reported. In cases when the primary source is a less common periodical or a report document, published though of limited availability, abstract references are also given;

(iii) experimental variables;

(iv) identification of the compiler;

(v) experimental values as they appear in the primary source. Whenever available, the data may be given both in tabular and graphical form. If auxiliary information is available, the experimental data are converted also to SI units by the compiler.

Under the general heading of Auxiliary Information, the essential experimental details are summarized:

(vi) experimental method used for the generation of data;
(vii) type of apparatus and procedure employed;
(viii) source and purity of materials;
(ix) estimated error;
(x) references relevant to the generation of experimental data as cited in the primary source.

This new approach to numerical data presentation, developed during our four years of existence, has been strongly influenced by the diversity of background of those whom we are supposed to serve. We thus deemed it right to preface the evaluation/compilation sheets in each volume with a detailed discussion of the principles of the accurate determination of relevant solubility data and related thermodynamic information.

Finally, the role of education is more than corollary to the efforts we are seeking. The scientific standards advocated here are necessary to strengthen science and technology, and should be regarded as a major effort in the training and formation of the next generation of scientists and engineers. Specifically, we believe that there is going to be an impact of our project on scientific-communication practices. The quality of consolidation adopted by this program offers down-to-earth guidelines, concrete examples which are bound to make primary publication services more responsive than ever before to the needs of users. The self-regulatory message to scientists of 15 years ago to refrain from unnecessary publication has not achieved much. The literature is still, in 1979, cluttered with poor-quality articles. The Weinberg report (in "Reader in Science Information", Eds. J. Sherrod and A. Hodina, Microcard Editions Books, Indian Head, Inc., 1973, p. 292) states that "admonition to authors to restrain themselves from premature, unnecessary publication can have little effect unless the climate of the entire technical and scholarly community encourages restraint..." We think that projects of this kind translate the climate into operational terms by exerting pressure on authors to avoid submitting low-grade material. The type of our output, we hope, will encourage attention to quality as authors will increasingly realize that their work will not be suited for permanent retrievability unless it meets the standards adopted in this project. It should help to dispel confusion in the minds of many authors of what represents a permanently useful bit of information of an archival value, and what does not.

If we succeed in that aim, even partially, we have then done our share in protecting the scientific community from unwanted and irrelevant, wrong numerical information.

A. S. Kertes

August, 1979

PREFACE

The present volume completes the compilation and evaluation of the solubility of the noble gases in liquids. The literature on the solubility of argon was covered through 1978. Some 1979 papers are cited.

The users of this volume will find (1) the experimental solubility data of argon gas in liquids as reported in the scientific literature, (2) tables of smoothed mole fraction solubility data for the systems which were studied over a temperature interval, and (3) tables of either tentative or recommended solubility data when two or more laboratories reported solubility data over the same range of temperature and pressure for a system. Users have the option of using the experimental values, either directly, or in their own smoothing equations, or of using the smoothed values prepared by the compilers and evaluators.

Some words of explanation are required with respect to units, corrections, smoothing equations, auxiliary data and data sources, nomenclature, and other points. The experimental data are presented in the units found in the original paper. In addition the original data are often converted to other units, especially mole fraction. Temperatures have been converted to Kelvin. In evaluations of solubility data, S.I. units are used.

Only in the past 10 to 15 years have experimental methods for the determination of the solubility of gases in liquids developed to the point where 0.5 percent or better accuracy is attained. Only a small fraction of the literature's gas solubility data are accurate to 0.5 percent. The corrections for non-ideal gas behavior and for expansion of the liquid phase on dissolution of the gas are small and well within the normal experimental error. Thus such corrections were not made for the gas solubility data at low pressure.

Most gas solubility measurements carried out near atmospheric conditions are measured at a total pressure near one atmosphere with the gas saturated with the solvent vapor. Usually the actual partial pressure of the gas is not known. In such experiments the Ostwald coefficient is the directly measured unit. The Bunsen coefficient and the mole fraction gas solubility at one atmosphere gas partial pressure are calculated from the Ostwald coefficient assuming that the Ostwald coefficient is independent of pressure. The assumption may not be exactly true, especially if the gas is at a partial pressure well below atmospheric, if the solvent has a very high vapor pressure, or if the gas is soluble enough to change the solvent properties from their pure liquid properties. This is a problem that both future evaluators and experimentors must pay more attention. The Bunsen coefficients and mole fraction solubility values calculated from Ostwald coefficients in this volume need to be used with the above caution in mind.

The lack of high accuracy is also the reason that only a two-constant equation is used to smooth and evaluate most of the gas solubility data. A Gibbs energy of solution equation linear in temperature is used

$$\Delta G°/\text{J mol}^{-1} = - RT \ln X_1 = A + BT$$

or in alternate form

$$\ln X_1 = - \Delta G°/RT = - (A/R)/T - (B/R)$$

where A is $\Delta H°$, B is $-\Delta S°$, X_1 is the mole fraction solubility at a gas partial pressure of 101.325 kPa (1 atm), and R is 8.31441 J K^{-1} mol^{-1}. The constants A and B require five digits to reproduce the mole fraction solubility to three significant figures. Although the constants are given to five digits it is not intended to imply that the values of the changes in enthalpy and entropy of solution are significant to more than two or three digits.

An inconsistency, which we believe is justified, is found with respect to the solubility data in water. Much time and effort were expended in evaluating the solubility data of each gas in water. A recommended equation and table of values are presented. However, for systems which contain water and other solvent compounds such as electrolytes or water miscible polar organic compounds, the experimental gas solubility in water from that paper is given, even when it is at variance with our recommended values. These data of sometimes poorer quality are presented because the author's ratio of gas solubility in water to solubility in the aqueous solution may be more accurate than the solubility itself. This may be especially true of some of the solubility data in aqueous electrolyte solutions.

Solvent density data were often required in making solubility unit conversions. The density data were not directly referenced. The main sources of density data are

- Circular 461 of the U.S. National Bureau of Standards
- American Petroleum Research Project 44 Publications
- The International Critical Tables, Volume III (E.W. Washburn, Editor) McGraw-Hill Co., 1931
- Smow Table, Pure and Applied Chemistry, 1976, 45, 1-9
- Thermodynamic Properties of Aliphatic Alcohols, R. C. Wilhoit and B. J. Zwolinski, J. Phys. Chem. Ref. Data 1973, 2, Supplement No. 1
- Organic Solvents, J. A. Riddick and W. B. Bunger (Technique of Chemistry, Volume II, A. Weissberger, Editor), Wiley-Interscience, New York, 1970, 3rd Ed.

The solubility data are supplemented with partial molal volume and calorimetric enthalpy of solution data when they are known.

Chemical Abstracts recommended names and registry numbers were used throughout. Common names are cross referenced to Chemical Abstract recommended names in the index. There is a registry number index.

The Editor would appreciate users calling errors and omissions to his attention.

The Editor gratefully acknowledges the advice and comments of members of the IUPAC Commission on Equilibrium Data and the Subcommittee on Solubility Data; the cooperation and hard work of the Evaluators and Compilers; and the untiring efforts of the typists Peggy Tyler, Carolyn Dowie, and Lesley Flanagan.

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H. Lawrence Clever

Atlanta, GA
August, 1979

THE SOLUBILITY OF GASES IN LIQUIDS

C. L. Young, R. Battino and H. L. Clever

INTRODUCTION

The Solubility Data Project aims to make a comprehensive search of the literature for data on the solubility of gases, liquids and solids in liquids. Data of suitable accuracy are compiled into data sheets set out in a uniform format. The data for each system are evaluated and where data of sufficient accuracy are available values recommended and in some cases a smoothing equation suggested to represent the variation of solubility with pressure and/or temperature. A text giving an evaluation and recommended values and the compiled data sheets are published on consecutive pages.

DEFINITION OF GAS SOLUBILITY

The distinction between vapor-liquid equilibria and the solubility of gases in liquids is arbitrary. It is generally accepted that the equilibrium set up at 300K between a typical gas such as argon and a liquid such as water is gas-liquid solubility whereas the equilibrium set up between hexane and cyclohexane at 350K is an example of vapor-liquid equilibrium. However, the distinction between gas-liquid solubility and vapor-liquid equilibrium is often not so clear. The equilibria set up between methane and propane above the critical temperature of methane and below the critical temperature of propane may be classed as vapor-liquid equilibrium or as gas-liquid solubility depending on the particular range of pressure considered and the particular worker concerned.

The difficulty partly stems from our inability to rigorously distinguish between a gas, a vapor, and a liquid,which has been discussed in numerous textbooks. We have taken a fairly liberal view in these volumes and have included systems which may be regarded, by some workers, as vapor-liquid equilibria.

UNITS AND QUANTITIES

The solubility of gases in liquids is of interest to a wide range of scientific and technological disciplines and not solely to chemistry. Therefore a variety of ways for reporting gas solubility have been used in the primary literature and inevitably sometimes, because of insufficient available information, it has been necessary to use several quantities in the compiled tables. Where possible, the gas solubility has been quoted as a mole fraction of the gaseous component in the liquid phase. The units of pressure used are bar, pascal, millimeters of mercury and atmosphere. Temperatures are reported in Kelvin.

EVALUATION AND COMPILATION

The solubility of comparatively few systems is known with sufficient accuracy to enable a set of recommended values to be presented. This is true both of the measurement near atmospheric pressure and at high pressures. Although a considerable number of systems have been studied by at least two workers, the range of pressures and/or temperatures is often sufficiently different to make meaningful comparison impossible.

Occasionally, it is not clear why two groups of workers obtained very different sets of results at the same temperature and pressure, although both sets of results were obtained by reliable methods and are internally consistent. In such cases, sometimes an incorrect assessment has been given. There are several examples where two or more sets of data have been classified as tentative although the sets are mutually inconsistent.

Many high pressure solubility data have been published in a smoothed form. Such data are particularly difficult to evaluate, and unless specifically discussed by the authors, the estimated error on such values can only be regarded as an "informed guess".

Many of the high pressure solubility data have been obtained in a more general study of high pressure vapor-liquid equilibrium. In such cases a note is included to indicate that additional vapor-liquid equilibrium data are given in the source. Since the evaluation is for the compiled data, it is possible that the solubility data are given a classification which is better than that which would be given for the complete vapor-liquid data (or vice versa). For example, it is difficult to determine coexisting liquid and vapor compositions near the critical point of a mixture using some widely used experimental techniques which yield accurate high pressure solubility data. For example, conventional methods of analysis may give results with an expected error which would be regarded as sufficiently small for vapor-liquid equilibrium data but an order of magnitude too large for acceptable high pressure gas-liquid solubility.

It is occasionally possible to evaluate data on mixtures of a given substance with a member of a homologous series by considering all the available data for the given substance with other members of the homologous series. In this study the use of such a technique has been very limited.

The estimated error is often omitted in the original article and sometimes the errors quoted do not cover all the variables. In order to increase the usefulness of the compiled tables estimated errors have been included even when absent from the original article. If the error on *any* variable has been inserted by the compiler this has been noted.

PURITY OF MATERIALS

The purity of materials has been quoted in the compiled tables where given in the original publication. The solubility is usually more sensitive to impurities in the gaseous component than to liquid impurities in the liquid component. However, the most important impurities are traces of a gas dissolved in the liquid. Inadequate degassing of the absorbing liquid is probably the most often overlooked serious source of error in gas solubility measurements.

APPARATUS AND PROCEDURES

In the compiled tables brief mention is made of the apparatus and procedure. There are several reviews on experimental methods of determining gas solubilities and these are given in References 1-7.

METHODS OF EXPRESSING GAS SOLUBILITIES

Because gas solubilities are important for many different scientific and engineering problems, they have been expressed in a great many ways:

The Mole Fraction, X(g)

The mole fraction solubility for a binary system is given by:

$$X(g) = \frac{n(g)}{n(g) + n(l)}$$

$$= \frac{W(g)/M(g)}{\{W(g)/M(g)\} + \{W(l)/M(l)\}}$$

here n is the number of moles of a substance (an *amount* of substance), W is the mass of a substance, and M is the molecular mass. To be unambiguous, the partial pressure of the gas (or the total pressure) and the temperature of measurement must be specified.

The Weight Per Cent Solubility, wt%

For a binary system this is given by

$$\text{wt\%} = 100\, W(g)/\{W(g) + W(l)\}$$

where W is the weight of substance. As in the case of mole fraction, the pressure (partial or total) and the temperature must be specified. The weight per cent solubility is related to the mole fraction solubility by

$$X(g) = \frac{\{wt\%/M(g)\}}{\{wt\%/M(g)\} + \{(100 - wt\%)/M(1)\}}$$

The Weight Solubility, C_W

The weight solubility is the number of moles of dissolved gas per gram of solvent when the partial pressure of gas is 1 atmosphere. The weight solubility is related to the mole fraction solubility at one atmosphere partial pressure by

$$X(g) \text{ (partial pressure 1 atm)} = \frac{C_W M(1)}{1 + C_W M(1)}$$

where M(1) is the molecular weight of the solvent.

The Moles Per Unit Volume Solubility, n

Often for multicomponent systems the density of the liquid mixture is not known and the solubility is quoted as moles of gas per unit volume of liquid mixture. This is related to the mole fraction solubility by

$$X = \frac{n\, v^o(1)}{1 + n\, v^o(1)}$$

where $v^o(1)$ is the molar volume of the liquid component.

The Bunsen Coefficient, α

The Bunsen coefficient is defined as the volume of gas reduced to 273.15K and 1 atmosphere pressure which is absorbed by unit volume of solvent (at the temperature of measurement) under a partial pressure of 1 atmosphere. If ideal gas behavior and Henry's law is assumed to be obeyed,

$$\alpha = \frac{V(g)}{V(1)} \frac{273.15}{T}$$

where V(g) is the volume of gas absorbed and V(1) is the original (starting) volume of absorbing solvent. The mole fraction solubility X is related to the Bunsen coefficient by

$$X \text{ (1 atm)} = \frac{\alpha}{\alpha + \frac{273.15}{T} \frac{v^o(g)}{v^o(1)}}$$

where $v^o(g)$ and $v^o(1)$ are the molar volumes of gas and solvent at a pressure of one atmosphere. If the gas is ideal,

$$X = \frac{\alpha}{\alpha + \frac{273.15R}{v^o(1)}}$$

Real gases do not follow the ideal gas law and it is important to establish the real gas law used for calculating α in the original publication and to make the necessary adjustments when calculating the mole fraction solubility.

The Kuenen Coefficient, S

This is the volume of gas, reduced to 273.15K and 1 atmosphere pressure, dissolved at a partial pressure of gas of 1 atmosphere by 1 gram of solvent.

The Ostwald Coefficient, L

The Ostwald coefficient, L, is defined as the ratio of the volume of gas absorbed to the volume of the absorbing liquid, all measured at the same temperature:

$$L = \frac{V(g)}{V(l)}$$

If the gas is ideal and Henry's Law is applicable, the Ostwald coefficient is independent of the partial pressure of the gas. It is necessary, in practice, to state the temperature and total pressure for which the Ostwald coefficient is measured. The mole fraction solubility, X, is related to the Ostwald coefficient by

$$X = \left[\frac{RT}{P(g)\ L\ v^{\circ}(l)} + 1 \right]^{-1}$$

where P is the partial pressure of gas. The mole fraction solubility will be at a partial pressure of P(g).

The Absorption Coefficient, β

There are several "absorption coefficients", the most commonly used one being defined as the volume of gas, reduced to 273.15K and 1 atmosphere, absorbed per unit volume of liquid when the total pressure is 1 atmosphere. β is related to the Bunsen coefficient by

$$\beta = \alpha(1-P(l))$$

where P(l) is the partial pressure of the liquid in atmosphere.

The Henry's Law Constant

A generally used formulation of Henry's Law may be expressed as

$$P(g) = K_H X$$

where K_H is the Henry's Law constant and X the mole fraction solubility. Other formulations are

$$P(g) = K_2 C(l)$$

or

$$C(g) = K_c C(l)$$

where K_2 and K_c are constants, C the concentration, and (l) and (g) refer to the liquid and gas phases. Unfortunately, K_H, K_2 and K_c are all sometimes referred to as Henry's Law constants. Henry's Law is a limiting law but can sometimes be used for converting solubility data from the experimental pressure to a partial gas pressure of 1 atmosphere, provided the mole fraction of the gas in the liquid is small, and that the difference in pressures is small. Great caution must be exercised in using Henry's Law.

The Mole Ratio, N

The mole ratio, N, is defined by

$$N = n(g)/n(l)$$

Table 1 contains a presentation of the most commonly used inter-conversions not already discussed.

For gas solubilities greater than about 0.01 mole fraction at a partial pressure of 1 atmosphere there are several additional factors which must be taken into account to unambiguously report gas solubilities. Solution densities or the partial molar volume of gases must be known. Corrections should be made for the possible non-ideality of the gas or the non-applicability of Henry's Law.

TABLE 1 Interconversion of parameters used for reporting solubility

$$L = \alpha(T/273.15)$$

$$C_W = \alpha/v_o\rho$$

$$K_H = \frac{17.033 \times 10^6 \rho_{soln}}{\alpha\ M(1)} + 760$$

$$L = C_W\ v_{t,gas}\rho$$

where v_o is the molal volume of the gas in $cm^3 mol^{-1}$ at 0°C, ρ the density of the solvent at the temperature of the measurement, ρ_{soln} the density of the solution at the temperature of the measurement, and $v_{t,gas}$ the molal volume of the gas ($cm^3 mol^{-1}$) at the temperature of the measurement.

SALT EFFECTS

The effect of a dissolved salt in the solvent on the solubility of a gas is often studied. The activity coefficient of a dissolved gas is a function of the concentration of all solute species (see ref. 8). At a given temperature and pressure the logarithm of the dissolved gas activity coefficient can be represented by a power series in C_s, the electrolyte concentration, and C_i, the nonelectrolyte solute gas concentration

$$\log f_i = \sum_{m,n} k_{mn} C_s^{\ n} C_i^{\ m}$$

It is usually assumed that only the linear terms are important for low C_s and C_i values when there is negligible chemical interaction between solute species.

$$\log f_i = k_s C_s + k_1 C_i$$

where k_s is the salt effect parameter and k_i is the solute-solute gas interaction parameter. The dissolved gas activity is the same in the pure solvent and a salt solution in that solvent for a given partial pressure and temperature

$$a_i = f_i S_i = f_i^{\,o} S_i^{\,o} \text{ and } f_i = f_i^{\,o}\ \frac{S_i^{\,o}}{S_i}$$

where S_i and $S_i^{\,o}$ are the gas solubility in the salt solution and in the pure solvent, respectively, and the f's are the corresponding activity coefficients. It follows that $\log \frac{f_i}{f_i^{\,o}} = \log \frac{S_i^{\,o}}{S_i} = k_s C_s + k_i (S_i - S_i^{\,o})$. When the quantity $(S_i - S_i^{\,o})$ is small the second term is negligible even though k_s and k_i may be of similar magnitude. This is generally the case for gas solubilities and the equation reduces to

$$\log \frac{f_i}{f_i^{\,o}} = \log \frac{S_i^{\,o}}{S_i} = k_s C_s$$

which is the form of the empirical Setschenow equation in use since the 1880's. A salt that increases the activity coefficient of the dissolved gas is said to salt-out and a salt that decreases the activity coefficient of the dissolved gas is said to salt-in.

Although salt effect studies have been carried out for many years, there appears to be no common agreement of the units for either the gas solubility or the salt concentration. Both molar ($mol\ dm^{-3}$) and molal ($mol\ kg^{-1}$) are used for the salt concentration. The gas solubility ratio $S_i^{\,o}/S_i$ is given as Bunsen coefficient ratio and Ostwald coefficient ratio, which would be the same as a molar ratio; Kueunen coefficient ratio, volume dissolved in 1 g or 1 kg of solvent which would be a molal ratio; and mole fraction ratio. Recent theoretical treatments use salt concentration in mol dm^{-3} and S_i°/S_i ratio as mole fraction ratio with each salt ion acting as a mole. Evaluations which compare the results of several workers are made in the units most compatible with present theory.

TEMPERATURE DEPENDENCE OF GAS SOLUBILITY

In a few cases it has been found possible to fit the mole fraction solubility at various temperatures using an equation of the form

$$\ln x = A + B / (T/100K) + C \ln (T/100K) + DT/100K$$

It is then possible to write the thermodynamic functions $\overline{\Delta G}^{\circ}_1$, $\overline{\Delta H}^{\circ}_1$, $\overline{\Delta S}^{\circ}_1$ and $\Delta\bar{C}^{\circ}_{p_1}$ for the transfer of the gas from the vapor phase at 101,325 Pa partial pressure to the (hypothetical) solution phase of unit mole fraction as:

$$\Delta\bar{G}^{\circ}_1 = -RAT - 100\ RB - RCT \ln (T/100) - RDT^2/100$$

$$\Delta\bar{S}^{\circ}_1 = RA + RC \ln (T/100) + RC + 2\ RDT/100$$

$$\Delta\bar{H}^{\circ}_1 = -100\ RB + RCT + RDT^2/100$$

$$\Delta\bar{C}^{\circ}_{p_1} = RC + 2\ RDT/100$$

In cases where there are solubilities at only a few temperatures it is convenient to use the simpler equations

$$\Delta\bar{G}^{\circ}_1 = -RT \ln x = A + BT$$

in which case $A = \Delta\bar{H}^{\circ}_1$ and $-B = \Delta\bar{S}^{\circ}_1$.

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COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. Water; H_2O; 7732-18-5	Rubin Battino Department of Chemistry Wright State University Dayton, OH 45431 U.S.A. December 1978

CRITICAL EVALUATION:

The experimental solubility data produced by eight workers was considered to be sufficiently reliable to use for smoothing. In fitting the data to the equation those points which differed by about two standard deviations or more from the smoothed values were rejected. We thus used 42 points which were obtained as follows (reference - number of data points used from that reference): 1-4, 2-9, 3-6, 4-6, 5-3, 6-3, 7-3, 8-2, 9-1, 10-2, 11-3. The fitting equation used was

$$\ln X_1 = A + B/(T/100K) + C \ln (T/100K) + DT/100K \qquad (1)$$

By using T/100K as the variable rather than T/K the coefficients in the smoothed equation are of roughly equal magnitude. The best fit for the 42 points gave

$$\ln X_1 = -57.6661 + 74.7627/(T/100K) + 20.1398 \ln (T/100K) \qquad (2)$$

where X_1 is the mole fraction solubility of the gas at 101.325 kPa (1 atm) partial pressure of the gas. The fit in ln X_1 gave a standard deviation of 0.26% taken at the middle of the temperature range. Table 1 gives smoothed values of the mole fraction at 101.325 kPa partial pressure of the gas and the Ostwald coefficient at 5K intervals.

Table 1 also gives the thermodynamic functions $\Delta\bar{G}^\circ_1$, $\Delta\bar{H}^\circ_1$, $\Delta\bar{S}^\circ_1$, and $\Delta\bar{C}^\circ_{p_1}$ for the transfer of gas from the vapor phase at 101.325 kPa partial pressure to the (hypothetical) solution phase of unit mole fraction. These thermodynamic properties were calculated from the smoothing equation according to the following equations:

$$\Delta\bar{G}^\circ_1 = -RAT - 100RB - RCT \ln (T/100) - RDT^2/100 \qquad (3)$$

$$\Delta\bar{S}^\circ_1 = RA + RC \ln (T/100) + RC + 2RDT/100 \qquad (4)$$

$$\Delta\bar{H}^\circ_1 = - 100RB + RCT + RDT^2/100 \qquad (5)$$

$$\Delta\bar{C}^\circ_{p_1} = RC + 2RDT/100 \qquad (6)$$

Several sets of data were rejected for various reasons. Clever and Reddy's single point (12) was too low by about 3%. Cargill and Morrison (13) presented their data graphically only. Sisskind and Kasarnovsky's single value (14) was 4% low. The single value reported by Novak and Conway was also low by about 5% (15). Of the three values reported by Patsatsiya and Krestov (16) two were low and the other was okay, so all three were rejected. The one value reported by Strakhov and Krestov (17) was about 3% low. The higher temperature (40 to 70° C) values reported by Krestov and Nedelko (18) were quite significantly low (16 to 20%). Ashton, <u>et al</u>.'s values (19) were between one and two percent high. The values determined by Shoor, <u>et al</u>., (20) by a gas chromatographic method were erratically high and low. The 25° C value by Clever, <u>et al</u>., (21) was 2% low. Antropoff's measurements were very high (22). The 25° C value reported by Akerlof (23) was very high. König's measurements (24) were 4 to 10% low. Friedman (25) reported two values, one of which was high and the other okay, but the set was rejected. Both values reported by Eucken and Hertzberg (26) were about 2% low. The three values by Patsatsiya and Krestov (27) were 2-3% low. The five values by Krestov and Nedelko (28) were also 2-3% low. Lannung's data (29) were erratically high and low, but close to the best data. Abrosimov <u>et al</u>.(36) reported five values from 10 to 45 °C which were 1 to 6 per cent different from the smoothed values and varied erratically.

Figure 1 shows the temperature dependence of the mole fraction solubility for argon. The curve was obtained from the smoothing equation. In the extrapolated values (beyond those used for the fitting equation) there appears to be a minimum at about 368K.

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. Water; H_2O; 7732-18-5	Rubin Battino Department of Chemistry Wright State University Dayton, OH 45431 U.S.A.

CRITICAL EVALUATION:

TABLE 1. Smoothed values of the solubility of argon in water,and thermodynamic functions[a] at 5K intervals using equation 2 at 101.325 kPa (1 atm) partial pressure of gas.

T/K	Mol Fraction $X_1 \times 10^3$	Ostwald Coefficient L	$\Delta\bar{G}_1^\circ$/kJ mol^{-1}	$\Delta\bar{H}_1^\circ$/kJ mol^{-1}	$\Delta\bar{S}_1^\circ$/J K^{-1}mol^{-1}
273.15	0.04284	0.05330	22.84	-16.42	-143.7
278.15	0.03775	0.04782	23.55	-15.58	-140.7
283.15	0.03362	0.04335	24.25	-14.75	-137.7
288.15	0.03025	0.03967	24.93	-13.91	-134.8
293.15	0.02748	0.03662	25.60	-13.07	-131.9
298.15	0.02519	0.03410	26.25	-12.24	-129.1
303.15	0.02328	0.03201	26.89	-11.40	-126.3
308.15	0.02169	0.03027	27.51	-10.56	-123.6
313.15	0.02036	0.02882	28.12	- 9.72	-120.9
318.15	0.01925	0.02762	28.72	- 8.89	-118.2
323.15	0.01832	0.02664	29.31	- 8.05	-115.6
328.15	0.01754	0.02585	29.88	- 7.21	-113.0
333.15	0.01690	0.02522	30.44	- 6.37	-110.5
338.15	0.01637	0.02473	30.98	- 5.54	-108.0
343.15	0.01594	0.02436	31.52	- 4.70	-105.5
348.15	0.01560	0.02412	32.04	- 3.86	-103.1

[a] $\Delta\bar{C}_{p_1}^\circ$ was independent of temperature and has the value 167 J K^{-1} mol^{-1} at 101.325 kPa partial pressure of gas.

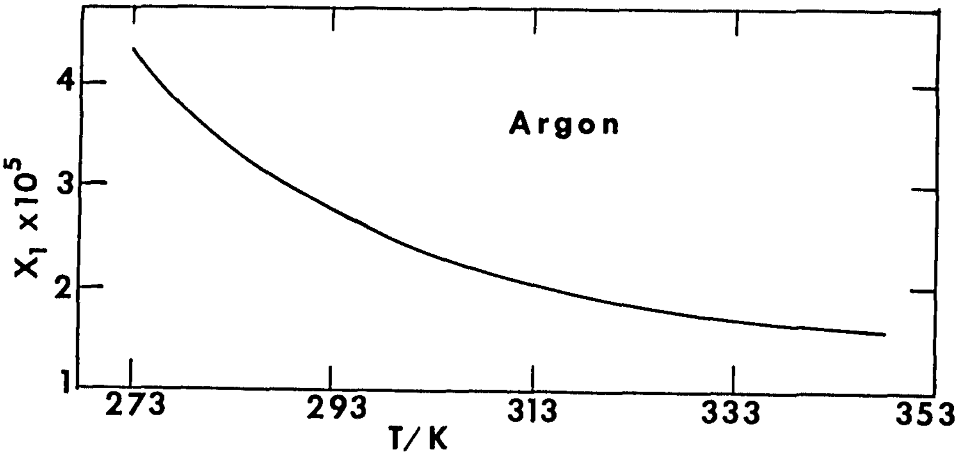

FIGURE 1. The mole fraction solubility of argon in water at 101.325 kPa (1 atm).

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. Water; H_2O; 7732-18-5	Rubin Battino Department of Chemistry Wright State University Dayton, OH 45431 U.S.A.

CRITICAL EVALUATION:

Alexander (30) measured the enthalpy of solution of argon in water at 298.15 K, and reported values of -11.2, -13.0, and -11.9 kJ mol^{-1}, average -12.1 ± 0.8 kJ mol^{-1}. The calorimetric enthalpy of solution of argon in water agrees well with the enthalpy value of -12.24 kJ mol^{-1} derived from the recommended equation for the mole fraction solubility of argon in water at 101.325 kPa and temperatures between 273.15 and 348.15 K.

There are at least four reports of the partial or apparent molal volume of argon in water at 298.15 K. Namiot (31) gives a value from the fit of high argon pressure solubility data to a theoretical equation. Enns, Scholander and Bradstreet (32) studied the equilibrium pressure of argon required to maintain a constant concentration of dissolved argon as the hydrostatic pressure on the solution varied from 34-102 atm,from which they derived a partial molal volume of argon in water. Tiepel and Gubbins (33) made direct dilatometer measurements at atmospheric pressure of argon dissolved in water and in several aqueous salt solutions. Popov and Drakin (34) calculated an apparent molal volume of argon in water from their measurements of the density of gas saturated water at pressures of 10 to 96 atm. They used the solubility data of Namiot and Bondareva to calculate the gas concentration in their solutions (35).

The partial and apparent molal volumes of argon dissolved in water are summarized in Table 2. The four sets of values agree well except for the data of Popov and Drakin, which ranges 70 percent higher than the other values. The present recommendation is that the value reported by Tiepel and Gubbins is the most reliable.

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COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. Water; H_2O; 7732-18-5	H. L. Clever Department of Chemistry Emory University Atlanta, GA 30322 U. S. A. August 1978

CRITICAL EVALUATION:

TABLE 2. Argon partial molal volume in water.

T/K	P/atm[a]	$\bar{V}_1/cm^3\ mol^{-1}$	Reference and Comments
298.15		32	Namiot (31) quotes the value from Namiot and Bondareva (35). (We have not been able to obtain a copy of the paper).
298.15	34 - 102	32.3 32.1	Enns, Scholander and Bradstreet (32). A study of the argon equilibrium pressure required to maintain a fixed concentration of argon dissolved in water as the hydrostatic pressure is increased from 34 to 102 atm.
298.15	1	31.71 ± 0.43	Tiepel and Gubbins (33). A careful dilatometric study of argon in water and in aqueous solutions of KCl, KI, $CaCl_2$, $(CH_3)_4NBr$ and $(C_4H_9)_4NBr$. For the $\bar{V}_1$ values in the salt solutions see the original paper.
298.15	9.67 - 95.80	55.2 ± 0.7	Popov and Drakin (34). The density of argon saturated H_2O was measured at about 10 atm intervals over the pressure range and apparent molal volumes were calculated using the solubility data of Namiot and Bondareva (35).

[a] 1 atm = 101.325 kPa

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ADDED NOTE: Matheson and King (37) report a value of the solubility of argon in water at 298.15 K which is 7.9 per cent higher than the recommended value. Potter and Clynne (38) report Henry's constants for argon + water at 13 temperatures from 298 to 561 K by a new method. At temperatures of 298, 303, 308 and 313 K the values agree with the recommended values with an average deviation of 0.20 %. At temperatures of 323, 338 and 353 K their values of the mole fraction solubility are 4.8, 14.0, and 21.6%higher than the recommended values. See pages 5-7.

37. Matheson,I.B.C.; King, A.D. J. Coll. Interface Sci. 1978, 66, 464.
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COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. Water; H_2O; 7732-18-5	H. L. Clever Department of Chemistry Emory University Atlanta, GA 30322 U. S. A. July 1979

CRITICAL EVALUATION:

Argon + Water: Evaluation Update

Potter and Clynne (1) have extended the measurements of the solubility of the noble gases in water to temperatures of 560 K and moderate pressures. They report measurements of the solubility of argon, and calculate Henry's constants from 298 to 561 K. The inverse of Potter and Clynne's Henry's constant is the mole fraction solubility of water at 101.325 kPa (1 atm). Their solubility values at temperatures near 298, 303, and 313 K deviate from Battino's recommended solubility values (pp 1 - 4) from 0.00 to 0.69 percent with an average deviation of under 0.20 per cent. At temperatures of 323, 338, and 353 K Potter and Clynne's values are greater than the recommended values by 4.8, 14.0, and 21.6 per cent respectively.

The experimental method of gas solubility determination used by Potter and Clynne is quite different than the methods used by others who have measured the solubility of argon in water in the room temperature range. The method appears to be reliable. The question is "are Potter and Clynne's data in the 323 - 353 K range more reliable than Battino's recommended solubility values?"

When evaluating gas solubility data, the higher values are usually given more weight because the two principle errors in measuring the solubility are incomplete degassing of the solvent and failure to establish equilibrium from the gas low pressure side. Both errors lead to low values of solubility. A third problem, that according to Horiuti (2) can lead to low results, is the measurement of the gas volumes under wet conditions (gas saturated with solvent vapor). Most methods used are "wet" methods. That low values of solubility are a problem is evident from Battino's evaluation. He used data from eleven papers to obtain his recommended values. He rejected data from about 20 papers, and of the rejected data about 80 percent were lower valued than the recommended data. One of the few papers that reported data consistently higher than the recommended was work done under "dry" conditions by Ashton, Dawe, Miller, Smith and Stickings (3). The Ashton, *et al.* value at 323.15 K is about two percent higher than the recommended value. They do not report values at higher temperatures where the deviations of Potter and Clynne's data are more pronounced.

Figure 1 shows the experimental values used by Battino to establish the recommended values (open symbols), Potter and Clynne's data in the region of deviation (solid circles), and the Ashton, *et al.* data at their three highest temperatures of measurement (solid squares). The solid line is from the recommended equation of Battino. The two dashed lines are for a 3 constant (-•-•-) and four constant (- -) fit to the data of Potter and Clynne plus all of the data used to obtain the recommended equation.

Figure 2 shows the data of Potter and Clynne and one point from the high pressure data of Sisskind and Kasarnowsky (4) with the same three curves running up to a temperature of 573 K. It is interesting that Battino's recommended equation based on data between 273 and 348 K does not deviate more than about 30 per cent from Potter and Clynne's experimental values even when extrapolated to a temperature as high as 561 K.

The question about the reliability of Potter and Clynne's data in the 323 - 365 K range cannot be answered without more experimental work in this important temperature range. It should be pointed out that Battino's recommended values above 323 K are based on data from only two papers (5,6). The recommended equation has a much stronger experimental basis at temperatures between 273 and 313 K than at temperatures of 323 K and above.

(Continued on the middle of page 7)

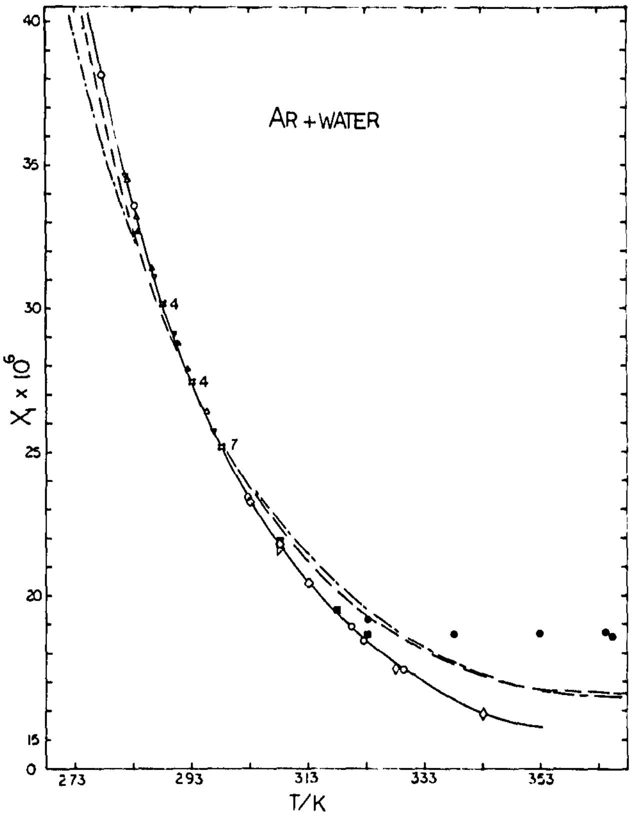

Figure 1. The solubility of argon in water. Values of mole fraction solubility = 1/Henry's constant against temperature. Battino's recommended values (solid line); Battino's selected data + Potter and Clynne's data three constant equation (-·-·-); four constant equation (-----). ● Potter and Clynne, ■ Ashton et al., ○ - 1, △ -2, ▽ - 3, ⬡ - 4, □ -5, ◇ - 6, ▽ - 7, ▢ - 8, ▽ - 10, ◊ - 11 (Numbers refer to references on page 3).

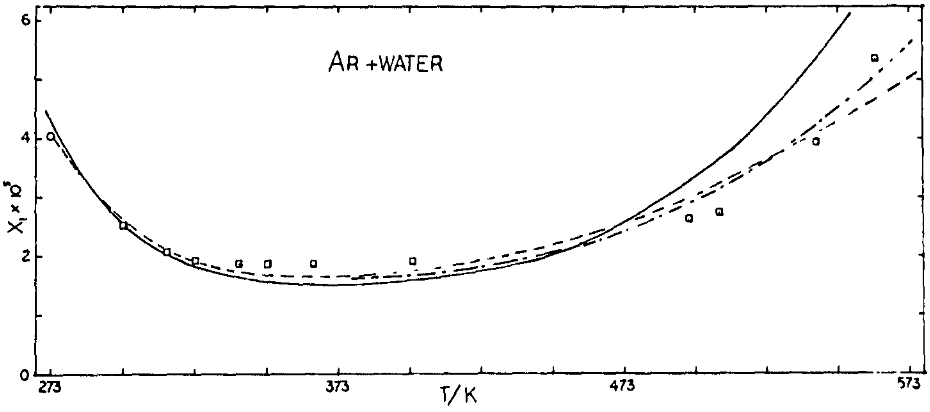

Figure 2. The solubility of argon in water. Values of mole fraction solubility = 1/Henry's constant against temperature. Caption continued on next page.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5

EVALUATOR:

H. L. Clever
Department of Chemistry
Emory University
Atlanta, GA 30322
U.S.A.

July 1979

CRITICAL EVALUATION:

Figure 2 (continued)
———— Recommended equation from experimental data from 273.15 - 348.15 K (Battino),
-·-·-·-· Three constant equation from selected data + Potter and Clynne values,
- - - - Four constant equation from selected data + Potter and Clynne values.
□ Potter and Clynne values,
○ Sisskind and Kasarnowsky value obtained from the equation $X_1 = aP + bP^2$.

In fitting all of the data to an equation one cannot statistically favor the four constant equation over the three constant equation. However, the four constant equation does appear to fit the low temperature data better and it is given here and in Figure 2 as a tentative equation for calculating the inverse of Henry's constant in the temperature range of 353 - 573 K.

$$\ln X_1 = \ln(1/K) = -80.8022 + 105.678/(T/100) + 40.644 \ln(T/100) - 3.2257(T/100)$$

The mole fraction solubility has only hypothetical significance at the higher temperatures where the system must be pressurized. Values of the thermodynamics of solution (ideal) at several temperatures based on the four constant equation are given in the table below.

T/K	Mol Fraction $X_1 \times 10^5$	Henry's Constant $K \times 10^{-4}$	$\Delta G°/J\ mol^{-1}$	$\Delta H°/J\ mol^{-1}$	$\Delta S°/J\ mol^{-1}$	$\Delta Cp/J\ K^{-1}\ mol^{-1}$
323.15	1.91	5.24	29,182	- 6,694	- 111.0	164.5
373.15	1.65	6.06	34,158	+ 861	- 89.2	137.7
423.15	1.92	5.21	38,207	7,075	- 73.6	110.9
473.15	2.56	3.91	41,595	11,949	- 62.7	84.1
523.15	3.58	2.79	44,535	15,188	- 55.5	57.2
573.15	4.98	2.01	47,202	17,680	- 51.4	30.4

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4. Sisskind, B.; Kasarnowsky, I. Z. Anorg. Chem. 1931, 200, 279.
5. Morrison, T. J.; Johnstone, N. B. J. Chem. Soc. 1954, 3441.
6. Krestov, G. A.; Nedel'ko, B. E. Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1969, 12, 1685.

The data sheets for the Potter and Clynne and the Sisskind and Kasarnowsky papers are in the high pressure section of the volume.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5

ORIGINAL MEASUREMENTS:

Lannung, A.

J. Am. Chem. Soc. 1930, *52*, 68-80.

VARIABLES:

T/K: 274.80 - 313.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α
274.8	0.04059	0.0505
285.55	0.03112	0.0387
291.15	0.02809	0.0349
293.05	0.02721	0.0338
293.15	0.02689	0.0334
298.15	0.02539	0.0315
303.15	0.02317	0.0287
308.15	0.02191	0.0271
313.15	0.02057	0.0254
313.15	0.02033	0.0251

The mole fraction solubility at 101.325 kPa (1 atm) partial pressure of the gas. The mole fraction was calculated by the compiler.

AUXILIARY INFORMATION

METHOD:

Water is degassed while over mercury. Gas uptake is measured on a gas buret.

APPARATUS/PROCEDURE:

The apparatus is based on the design of v. Antropoff (1). The entire apparatus is designed to be shaken inside of a thermostat.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Linde.
2. Water. Distilled. Specific conductivity of 2×10^{-7}

ESTIMATED ERROR:

$\delta T/K = 0.03$

REFERENCES:

1. v. Antropoff, A. *Z. Elektrochem.* 1914, *25*, 269.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5

ORIGINAL MEASUREMENTS:

Morrison, T.J.; Johnstone, N.B.

J. Chem. Soc. 1954, 3441-3446.

VARIABLES:

T/K: 283.85 - 347.25
P/kPa: 101.325 (1 atm)

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^3$	Kuenen Coefficient $S_o \times 10^3$
283.85	0.03288	40.9
287.45	0.02992	37.2
291.35	0.02785	34.6
297.55	0.02507	31.1
302.95	0.02284	28.3
309.75	0.02095	25.9
312.55	0.02033	25.1

T/K	Mol Fraction $x_1 \times 10^3$	Kuenen Coefficient $S_o \times 10^3$
320.95	0.01877*	23.1
322.65	0.01838*	22.6
329.45	0.01738*	21.3
339.45	0.01657	20.2
344.45	0.01596	19.4
347.25	0.01574*	19.1

*Solubility values which were used in the final smoothing equation for the recommended solubility values given in the critical evaluation.

The solubility values reported above as Kuenen coefficient x 10^3 were given in the original paper as cm^3 argon at a partial pressure of 760 torr, reduced to 760 torr and 273.15K dissolved by 1 kg water.

The authors fitted their solubility data to the equation $\log_{10}S =$

$- 60.272 + 3290/(T/K)$.

The mole fraction solubility at an argon partial pressure of 101.325 kPa (1 atm) was calculated by the compiler.

AUXILIARY INFORMATION

METHOD:

The previously degassed solvent flows in a thin film through the gas in a glass absorption helix. Volume changes are measured in burets.

APPARATUS/PROCEDURE:

The apparatus described by Morrison and Billett (1) was used.

SOURCE AND PURITY OF MATERIALS:

1. Argon. British Oxygen Co., Ltd. Spectroscopically pure.
2. Water. No information given.

ESTIMATED ERROR:

REFERENCES:

1. Morrison, T.J.; Billett, F. J. Chem. Soc. 1952, 3819.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5

ORIGINAL MEASUREMENTS:

Klots, C.E.; Benson, B.B.

J. Marine Res. (Sears Found. Marine Res.) 1963, 21, 48 - 57.

VARIABLES:

T/K: 275.50 - 299.87
P/kPa: 101.325 (1 atm)

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α
275.50	0.04070	0.05064
276.17	0.03994	0.04969
279.91	0.03634	0.04521
282.10	0.03446*	0.04287
283.71	0.03321*	0.04130
284.40	0.03273*	0.04070
286.34	0.03142*	0.03907
288.16	0.03017*	0.03751
290.76	0.02877*	0.03575
292.45	0.02786*	0.03461
293.37	0.02743*	0.03407
295.54	0.02642*	0.03280
297.53	0.02556	0.03171
298.74	0.02506	0.03108
299.87	0.02465	0.03057

*Solubility values which were used in the final smoothing equation for the recommended solubility values given in the critical evaluation.

The mole fraction solubility at 101.325 kPa (1 atm) partial pressure of argon calculated by the compiler.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Degassed water is equilibrated with a gas for up to 48 hrs by rocking it between two bulbs. The total solution volume is precisely known. The gas is extracted with a toepler pump and its quantity measured in the dry state so that corrections for non-ideality may be made. The equilibration is done very gently to prevent supersaturation.

SOURCE AND PURITY OF MATERIALS:

1. Argon. No source cited. 99.9 per cent.
2. Water. Distilled.

ESTIMATED ERROR:

$\delta T/K = 0.01$
$\delta X_1/X_1 = 0.001$

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5

ORIGINAL MEASUREMENTS:

Ben-Naim, A.; Baer, S.

Trans. Faraday Soc. 1963, *59*, 2735-2738.

VARIABLES:

T/K: 276.05 - 301.05
P/kPa: 101.325 (1 atm)

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Ostwald Coefficient L
276.05	0.03996	0.05025
281.85	0.03463*	0.04445
283.15	0.03379	0.04357
286.75	0.03107*	0.04056
290.15	0.02911*	0.03843
292.85	0.02761	0.03677
296.85	0.02573*	0.03470
298.35	0.02509*	0.03400
301.05	0.02415	0.03299

*Solubility values which were used in the final smoothing equation for the recommended solubility values given in the critical evaluation.

Mole fraction solubility of gas at 101.325 kPa (1 atm) partial pressure of gas was calculated by the compiler.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

A calibrated dissolution vessel contains degassed water. Gas is introduced wet from a calibrated gas buret system. Stirring the liquid forces it up to sidearms attached to the top of the flask and the liquid returns via a central tube. The amount of gas dissolved is determined via the gas burets. The entire apparatus is thermostated in a water bath. 97% of the gas dissolves in 30 min., the remainder in 4 hrs. of slow stirring.

SOURCE AND PURITY OF MATERIALS:

1. Argon. No comment by authors.
2. Water. Authors stated it was "pure".

ESTIMATED ERROR:

$$\delta X_1/X_1 = 0.002$$

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5

ORIGINAL MEASUREMENTS:

Douglas, E.

J. Phys. Chem. 1964, 68, 169-174.

VARIABLES:

T/K: 277.77 - 302.85
P/kPa: 101.325 (1 atm)

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen[a] Coefficient α
277.77	0.03815*	.04746
283.15	0.03361*	.04180
288.19	0.03017*	.03750
293.15	0.02742*	.03405
298.35	0.02510*	.03113
302.85	0.02342*	.02901

*Solubility values which were used in the final smoothing equation for the recommended solubility values given in the critical evaluation.

[a] Each value reported above is the average of five experimental determinations. The greatest percentage standard deviation was 0.17.

Mole fraction solubility of gas at 101.325 kPa (1 atm) partial pressure of gas was calculated by the compiler.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The apparatus and procedure are based on the Scholander microgasometric apparatus (1). This version uses one arm with an expanded solvent reservoir. Degassed water is introduced to this reservoir and sealed over mercury. The water is then tipped into the absorption chamber. Gas is introduced and the entire apparatus is shaken in a water thermostat (± 0.01°C). Gas and liquid volumes are read on a micrometer syringe by displacement of mercury.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Source not given. 98.9% pure.
2. Water. Double-distilled.

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.0025 - 0.0050.$

REFERENCES:

1. Scholander, P.F. J. Biol. Chem. 1947, 167, 235.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5

ORIGINAL MEASUREMENTS:

Ben-Naim, A. J. Phys. Chem. 1965, 69, 3245-3250.

VARIABLES:

T/K: 278.15 - 298.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Ostwald Coefficient L
278.15	0.03794	0.04807
283.15	0.03363	0.04336
288.15	0.03017*	0.03956
293.15	0.02748*	0.03663
298.15	0.02517*	0.03408

*Solubility value which were used in the final smoothing equation for the recommended solubility values given in the critical evaluation.

Mole fraction solubility at 101.325 kPa (1 atm) partial pressure of gas was calculated by the compiler.

AUXILIARY INFORMATION

METHOD:

Used the apparatus of Ben-Naim and Baer (1) in which a calibrated dissolution vessel contains degassed water. Gas is introduced wet from a gas buret system. Stirring forces the liquid through the gas. The amount of gas dissolved is measured on a gas buret.

APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

1. Argon. No information given.
2. Water. No information given.

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.002$

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5

ORIGINAL MEASUREMENTS:

Clever, H.L.; Holland, C.J.

J. Chem. Eng. Data 1968, *13*, 411-414.

VARIABLES:

T/K: 298.15 - 313.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α
298.15	0.02539	0.0315
303.15	0.02325*	0.0288
308.15	0.02175*	0.0269
313.15	0.02041*	0.0252

*Solubility values which were used in the final smoothing equation for the recommended solubility values given in the critical evaluation.

Mole fraction solubility of gas at 101.325 kPa (1 atm) partial pressure of gas was calculated by the compiler.

AUXILIARY INFORMATION

METHOD:

They used a modification of the Markham and Kobe (1) apparatus. This apparatus has an absorption vessel with two compartments, one above the other. Degassed liquid from the top compartment drains into the gas in the lower compartment. Shaking effects solution. Volumes and pressures are measured.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co. 99.99 per cent.
2. Water. Distilled.

APPARATUS/PROCEDURE:

This paper also lists salting out coefficients for argon in aqueous solutions of LiCl, NaCl, NaBr, and KCl.

ESTIMATED ERROR:

REFERENCES:

1. Markham, A.E.; Kobe, K.A. *J. Am. Chem. Soc.* 1941, *63*, 449.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5

ORIGINAL MEASUREMENTS:

Ashton, J. T.; Dawe, R. A.;
Miller, K. W.; Smith, E. B.;
Stickings, B. J.

J. Chem. Soc (A) 1968, 1793 - 1796.

VARIABLES:

T/K: 278.15 - 323.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^5$	Kuenen Coefficient $S \times 10^3$
278.15	3.83	47.6
283.15	3.40	42.3
288.15	3.05	38.0
293.15	2.77	34.5
298.15	2.55	31.7
308.15	2.19	27.3
318.15	1.95	24.3
323.15	1.86	23.1

The mole fraction solubility values were calculated by the compiler.

The mole fraction solubility values above are 1 to 2 per cent higher than the recommended values. The work appears to have been carried out with care. The results may be significant in view of the recent report of Potter and Clynne (2) (data sheet in high pressure section) of higher argon solubility values at temperatures above 313 K than those recommended.

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE: The apparatus is designed for the measurement of gas solubilities of the order of 10^{-6} mole fraction. It allows the bulk of the gas measurement to be preformed under "dry" conditions. Horiuti's analysis suggests that "wet"(solvent vapor saturated gas) frequently gives low gas solubility values.

The apparatus consists of a gas buret, a 1200 cm^3 cylinrically shaped solution vessel with magnetically driven stirrers at top and bottom, and a secondary buret which also acted as a manometer. Connections are of 1 mm capillary tubing.

The water is degassed by boiling under vacuum for five hours. The apparatus is evacuated and filled. The gas and water are contacted and stirred for 12 hours. Measurements are made at pressures between 600 and 1200 mmHg. Henry's law is obeyed. The solubility at one atm is obtained by interpolation.

SOURCE AND PURITY OF MATERIALS:

1. Argon. British Oxygen Co. Mass-spectrographic analysis showed it to be better than 99.9 per cent pure.
2. Water. Doubly distilled.

ESTIMATED ERROR:

$\delta S/S = 0.01$ (random)
$\delta S/S = 0.003$ (repeat)
$\delta T/K = 0.02$ (apparatus)
$\delta T/K = 0.05$ (gas buret)

REFERENCES:

1. Horiuti, J. Sci. Papers Inst. Phys. Chem. Res. Tokyo 1931, 17, 125.
2. Potter, R. W.; Clynne, M. A. J. Soln. Chem. 1978, 7, 837.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5

ORIGINAL MEASUREMENTS:

Krestov, G.A.; Nedelko, B.E.

Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1969, 12, 1685-1691.

VARIABLES:

T/K: 313.15 - 343.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
313.15	0.01985	0.0245	0.02809
318.15	0.01899	0.0234	0.02726
323.15	0.01790	0.0220	0.02603
328.15	0.01745*	0.0214	0.02571
333.15	0.01676	0.0205	0.02500
338.15	0.01615	0.0197	0.02439
343.15	0.01586*	0.0193	0.02425

*Solubility values which were used in the final smoothing equation for the recommended solubility values given in the critical evaluation.

Mole fraction solubility at 101.325 kPa (1 atm) partial pressure of gas and Ostwald coefficient calculated by the compiler.

AUXILIARY INFORMATION

METHOD:

Presumably used the apparatus described by Patsatsiya and Krestov (1) which is based on that of Ben-Naim and Baer (2). Solvent degassed by boiling for four hours under vacuum. Degassed solvent thermostatted for two hours. Gas is saturated with solvent before entering system. Gas uptake determined on thermostatted gas buret. Also measured solubility in aqueous glycerol mixtures.

APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.01$ (compiler)

REFERENCES:

1. Patsatsiya, K.M.; Krestov, G.A. Zh. Fiz. Khim. 1970, 44, 1835.
2. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Argon; Ar; 7440-37-1 2. Water; H_2O; 7732-18-5	Murray, C.N.; Riley, J.P. Deep-Sea Res. 1970, 17, 203 - 209.
VARIABLES:	**PREPARED BY:**
T/K: 274.20 - 308.15 P/kPa: 101.325 (1 atm)	R. Battino

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen[a] Coefficient α
274.20	0.04183	0.052045
278.15	0.03762	0.046812
283.15	0.03349	0.041655
288.15	0.03015	0.037478
293.22	0.02740*	0.034030
298.15	0.02520*	0.031258
302.23	0.02331	0.028874
308.15	0.02176*	0.026912

*Solubility values which were used in the final smoothing equation for the recommended solubility values given in the critical evaluation.

[a] Experimental values reported to five significant figures in original paper.

Mole fraction solubility at 101.325 kPa (1 atm) partial pressure of gas was calculated by the compiler.

AUXILIARY INFORMATION

METHOD:	SOURCE AND PURITY OF MATERIALS:
Used a modification of the Ben-Naim and Baer (1) apparatus. Liquid is pumped through the gas. Uptake is measured on gas burets. Liquid and solution are in a calibrated vessel. See ref. 2 for modification.	1. Argon. British Oxygen Co. 99.99 per cent. 2. Water. Distilled.
APPARATUS/PROCEDURE:	**ESTIMATED ERROR:**
	$\delta X_1/X_1 = 0.0013$
	REFERENCES:
	1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735. 2. Murray, C.N.; Riley, J.P.; Wilson, T.R.S. Deep-Sea Research 1969, 16, 297.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5

ORIGINAL MEASUREMENTS:

Weiss, R.F.

Deep-Sea Res. 1971, 18, 225 - 230.

VARIABLES:

T/K: 298.18
P/kPa: 101.325 (1 atm)

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α
298.18	0.02511*	0.03115
298.18	0.02525*	0.03132
298.18	0.02503	0.03105

*Solubility values which were used in the final smoothing equation for the recommended solubility values given in the critical evaluation.

Mole fraction solubility at 101.325 kPa (1 atm) partial pressure of gas was calculated by the compiler.

AUXILIARY INFORMATION

METHOD:

A gas chromatographic procedure was used. This was based on the procedure of Swinnerton et al., (1,2) in which a dissolved gas is stripped and passed on to a gas chromatograph. The gas is stripped with helium carrier gas.

APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

1. Argon. No information given.
2. Water. Distilled.

ESTIMATED ERROR:

REFERENCES:

1. Swinnerton, J.W.; Linnenbom, V.J.; Cheek, C.H. Anal. Chem. 1962, 34, 483.
2. Swinnerton, J.W.; Linnenbom, V.J.; Cheek, C.H. Anal. Chem. 1962, 34, 1509.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5

ORIGINAL MEASUREMENTS:

Masterton, W.L.; Polizzotti, D.; Welles, H.

J. Solution Chem. 1973, 2, 417-423.

VARIABLES:

T/K: 298.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Ostwald Coefficient L	mol Ar dm^{-3} $n \times 10^3$
298.15	0.02522*	0.03415	1.396

*Solubility value which was used in the final smoothing equation for the recommended solubility values given in the critical evaluation.

The mole fraction solubility at 101.325 kPa (1 atm) partial pressure of gas and the Ostwald coefficient were calculated by the compiler.

AUXILIARY INFORMATION

METHOD:

The apparatus used was the Wen and Hung (1) modification of the Ben-Naim and Baer apparatus (2). The volume of the dissolution vessel was 200 cm^3. Also studied were argon solubilities in aqueous solutions of t-[Co(en)$_2$NCSCl]Br.

APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co. 99.998 percent pure.
2. Water. Distilled, conductivity 10^{-6} mho cm^{-1}.

ESTIMATED ERROR:

$\delta P/\text{atm} = 0.004$
$\delta T/\text{K} = 0.02$
$\delta V/\text{cm}^3 = 0.01$

REFERENCES:

1. Wen, W.Y.; Hung, J.H. J. Phys. Chem. 1970, 74, 170.
2. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. Water-d_2; D_2O; 7789-20-0	Rubin Battino, Department of Chemistry, Wright State University, Dayton, Ohio, 45431 U.S.A. June 1978.

CRITICAL EVALUATION:

The experimental data of three workers were used for the smoothing equation. In fitting the data to the smoothing equation those points which differed by about two standard deviations or more from the smoothed values were rejected. We thus used 13 points as follows (reference - number of data points used from that reference): 1-3; 2-5; 3-5. The fitting equation used was

$$\ln x_1 = A + B/(T/100K) + C \ln (T/100K) \qquad (1)$$

The best fit for the 13 points gave

$$\ln x_1 = -42.5425 + 54.8437/(T/100K) + 12.4767 \ln (T/100K) \qquad (2)$$

where x_1 is the mole fraction solubility of the gas at 101.325 Pa (1 atm) partial pressure of the gas. The fit in $\ln x_1$ gave a standard deviation of 0.69% taken at the middle of the temperature range. Table 1 gives smoothed values of the mole fraction at 101.325 Pa partial pressure of gas and the Ostwald coefficient at 5 K intervals.

Table 1 also gives the thermodynamic functions $\Delta\bar{G}^\circ_1$, $\Delta\bar{H}^\circ_1$, $\Delta\bar{S}^\circ_1$, and $\Delta\bar{C}^\circ_{p_1}$ for the transfer of the gas from the vapor phase at 101.325 Pa partial pressure to the (hypothetical) solution phase of unit mole fraction. These thermodynamic properties were calculated from the smoothing equation according to the following equations:

$$\Delta\bar{G}^\circ_1 = - RAT - 100RB - RCT \ln (T/100) - RDT^2/100 \qquad (3)$$

$$\Delta\bar{H}^\circ_1 = - 100RB + RCT + RDT^2/100 \qquad (4)$$

$$\Delta\bar{S}^\circ_1 = RA + RC \ln (T/100) + RC + 2RDT/100 \qquad (5)$$

$$\Delta\bar{C}^\circ_{p_1} = RC + 2RDT/100 \qquad (6)$$

There were only the three sets of data reported in the literature. Ben-Naim's data were extrapolated from a linear least squares fit of solubility in H_2O/D_2O mixtures of 0.03, 0.5, and 0.9 mole fraction in D_2O(3).

References

1. Abrosimov, V.K.; Strakhov, A.N.; Krestov, G.A. Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol. 1974, 17, 1463-5; CA 82:65031y.
2. Ben-Naim, A. J. Chem. Phys. 1965, 42, 1512-3.
3. Ben-Naim, A. J. Chem. Phys. 1966, 45, 1848-9.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water-d_2; D_2O; 7789-20-0

EVALUATOR:

Rubin Battino, Department of
Chemistry, Wright State
University, Dayton, Ohio,
45431 U.S.A.

June 1978

CRITICAL EVALUATION:

Table 1. Smoothed values of argon solubility in D_2O and Thermodynamic functions* using equation 2 at 101.325 Pa partial pressure of gas.

T/K	Mole Fraction $X_1 \times 10^5$	Ostwald Coefficient $L \times 10^2$	$\Delta\bar{G}^\circ_1/\mathrm{kJmol}^{-1}$	$\Delta\bar{H}^\circ_1/\mathrm{kJmol}^{-1}$	$\Delta\bar{S}^\circ_1/\mathrm{JK}^{-1}\mathrm{mol}^{-1}$
278.15	4.268	5.408	23.27	-16.74	-143.9
283.15	3.763	4.853	23.98	-16.23	-142.0
288.15	3.346	4.387	24.69	-15.71	-140.2
293.15	2.997	3.995	25.39	-15.19	-138.4
298.15	2.705	3.662	26.07	-14.67	-136.7
303.15	2.457	3.378	26.75	-14.15	-134.9
308.15	2.247	3.135	27.42	-13.63	-133.2
313.15	2.067	2.926	28.08	-13.11	-131.6
318.15	1.913	2.745	28.74	-12.60	-129.9

$^*\Delta\bar{C}^\circ_{p_1}$ was independent of temperature and has the value 104 J mol^{-1} K^{-1}.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water-d_2; D_2O; 7789-20-0

ORIGINAL MEASUREMENTS:

Ben-Naim, A.
J. Chem. Phys.
1966, 45, 1848-1849.

VARIABLES:

T/K: 278.15 - 298.15

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K	Mol Fraction[a] $X_1 \times 10^5$	Ostwald Coefficient[b] $L \times 10^2$
278.15	4.292*	5.408
283.15	3.745*	4.805
288.15	3.327*	4.344
293.15	2.988*	3.966
298.15	2.719*	3.668

*Solubility values which were used in the final smoothing equation for the recommended solubility values given in the critical evaluation.

[a] Mole fraction solubility at 101.325 kPa (1 atm) partial pressure of gas calculated by compiler.

[b] The Ostwald coefficients extrapolated by a least squares fit of solubility in H_2O/D_2O mixtures of 0.03, 0.5, and 0.9 mole fraction D_2O.

AUXILIARY INFORMATION

METHOD:

The Ben-Naim and Baer apparatus (1) was used for these measurements.

APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

1. Argon - no comment by author.
2. D_2O - no comment by author.

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.0025$ (compiler)

REFERENCES:

1. Ben-Naim, A.; Baer, S.
Trans. Faraday Soc.
1963, 59, 2735.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water-d_2; D_2O; 7789-20-0

ORIGINAL MEASUREMENTS:

Ben-Naim, A.
J. Chem. Phys.
1965, *42*, 1512-1513.

VARIABLES:

T/K: 278.15 - 298.15

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^5$	Ostwald Coefficient $L \times 10^2$	Ostwald Coefficient $L \times 10^2$
278.15	4.282*	5.394_5	5.395, 5.394
283.15	3.753*	4.815_5	4.819, 4.810, 4.816
288.15	3.324*	4.340	4.346, 4.337, 4.337
293.15	3.002*	3.985	3.986, 3.983, 3.987
298.15	2.732*	3.686	3.686, 3.685, 3.686

*Solubility values which were used in the final smoothing equation for the recommended solubility values given in the critical evaluation.

The mole fraction solubility at 101.325 kPa (1 atm) partial pressure of gas calculated by compiler.

The experimental Ostwald coefficients are in the column to the right, the average Ostwald coefficients are in the column to the left.

AUXILIARY INFORMATION

METHOD:

The Ben-Naim and Baer apparatus was used for these measurements (1).

APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

1. Argon - no comment by authors.
2. D_2O - 99.7% from Norsh-Hydro-Elektrisk.

ESTIMATED ERROR:

$\delta X_2/X_2 = 0.0025$ (compiler)

REFERENCES:

1. Ben-Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water-d_2; D_2O; 7789-20-0

ORIGINAL MEASUREMENTS:

Abrosimov, V.K.; Strakhov, A.N.; Krestov, G.A.
<u>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</u>
<u>1974</u>, <u>17</u>, 1463-5; CA<u>82</u>: 65031y.

VARIABLES:

T/K: 283.38 - 318.45

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^4$	Ostwald Coefficient $L \times 10^2$
283.38	0.3931	5.048
292.72	0.3069	4.068
298.15	0.2717*	3.666
308.25	0.2226*	3.097
318.45	0.1905*	2.728

*Solubility values which were used in the final smoothing equation for the recommended solubility values given in the critical evaluation.

The mole fraction solubility at 101.325 kPa (1 atm) partial pressure of gas was calculated by compiler.

The authors also determined solubility at 0.01, 0.03, 0.05, 0.10, 0.30, and 0.60 mole fraction of D_2O in H_2O.

AUXILIARY INFORMATION

METHOD:

APPARATUS/PROCEDURE:

The apparatus (1) is a modification of the apparatus used by Ben-Naim and Baer (2).

SOURCE AND PURITY OF MATERIALS:

No information given.

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.01$ (compiler)

REFERENCES:

1. Patsatsiya, K.M.; Krestov, G.A. <u>Zh. Fiz. Khim.</u> 1970, <u>44</u>, 1835.
2. Ben-Naim, A.; Baer, S. <u>Trans.Faraday Soc.</u> <u>1963</u>, <u>59</u>, 2735.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Water-d_2; D_2O; 7789-20-0

ORIGINAL MEASUREMENTS:

Ben-Naim, A.

J. Chem. Phys. 1966, *45*, 1848-1849.

VARIABLES:

T/K: 278.15 - 298.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

Water + Water-d_2 Mixed Solvent

D_2O/X_3	0.00 (extrapolated by compiler)		0.03	0.50	0.90
T/K	Mol Fraction $X_1 \times 10^3$	Ostwald Coefficient L	Ostwald Coefficient L	Ostwald Coefficient L	Ostwald Coefficient L
278.15	0.03819	0.04839	0.04860	0.05115	0.05356
283.15	0.03374	0.04351	0.04370	0.04566	0.04766
288.15	0.03018*	0.03958	0.03981	0.04127	0.04318
293.15	0.02757	0.03675	0.03685	0.03818	0.03938
298.15	0.02513*	0.03403	0.03415	0.03528	0.03646

*Solubility values which were used in the final smoothing equation for the recommended solubility values given in the critical evaluation.

The mole fraction solubility and Ostwald coefficient in pure H_2O were obtained by extrapolation of the water + water-d_2 Ostwald coefficients by the compiler.

AUXILIARY INFORMATION

METHOD:

No comment is made by the author, but presumably the Ben-Naim and Baer apparatus (1) was used.

SOURCE AND PURITY OF MATERIALS:

1. Argon. No comment by author.
2. Water. No comment by author.

APPARATUS/PROCEDURE:

ESTIMATED ERROR:

REFERENCES:

1. Ben-Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Water-d_2; D_2O; 7789-20-0

ORIGINAL MEASUREMENTS:

Abrosimov, V. K.; Strakhov, A. N.; Krestov, G. A.

Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1974, 17, 1463 - 1465.

VARIABLES:

T/K: 283.38 - 318.48
P/kPa: 101.325 (1 atm)
D_2O/X_3: 0.00 - 1.00

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Mol Fraction	Ostwald coefficient/L x 10^3				
D_2O/X_3	283.38	292.72	298.15	308.25	318.48
0.00	45.71	37.90	34.46	29.45	26.09
0.01	46.19	38.05	34.50	29.44	26.09
0.03	46.52	39.20	34.56	29.55	26.06
0.05	46.60	38.21	34.58	29.56	26.10
0.10	46.66	39.25	34.59	29.64	26.20
0.30	47.49	38.91	35.25	30.06	26.37
0.60	48.28	39.73	36.00	30.71	27.09
1.00	50.48	40.68	36.66	30.97	27.28

The authors have used the above data in another paper in which they discuss the effect of the structure of water with different degrees of deuteration on the thermodynamic characteristics of argon dissolution at 273 to 353 K. See Abrosimov, V. K.; Strakhov, A. N.; Krestov, G. A.
Zh. Strukt. Khim. 1976, 17, 1027 - 1035.
J. Struct. Chem. 1976, 17, 877 - 884 (Engl.trans.).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus is a modification of the apparatus of Ben-Naim and Baer (1). Modifications include a degassing vessel connected directly to the absorption cell, a bubbling vessel to presaturate the gas with solvent vapor, and means to maintain the gas supply at a constant pressure. The entire apparatus is immersed in a 400 liter water bath controlled to within 0.005 K (2,3).

The solvent is degassed by boiling four hours under vacuum. Degassed solvent is admitted to the 639 ml absorption cell. Gas, presaturated with solvent vapor, is admitted. After 30 minutes rapid stirring 98% of the gas is dissolved. Slow stirring is continued for 2 hours to insure equilibrium. The mixed solvent is prepared by weight. The composition is checked after the solution process by density and refractive index measurements.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially pure grade designated MRTU-6-02-377-66. Contained not more than 0.004% N_2 and 0.001% O_2.
2. Water. Doubly distilled.
3. Water-d_2.

ESTIMATED ERROR:

$\delta T/K = 0.005$
$\delta \gamma/\gamma = 0.002 - 0.004$

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.
2. Nedel'ko, B. E.; Krestov, G. A. Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1969, 12, 998.
3. Patsatsiya, K. M.; Krestov, G. A. Zh. Fiz. Khim. 1970, 44, 1835.

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. Seawater	Chen-Tung A. Chen School of Oceanography Oregon State University Corvallis OR 97331 June 1979

CRITICAL EVALUATION:

There is considerable disagreement about the precise argon solubility in seawater. The earlier determinations of Rakestraw and Emmel (1) and Konig (2) cover limited salinity and temperature range and the results differ widely (3%) from currently accepted values. As a result, these measurements will not be analyzed.

The studies of Douglas (3,4) are of good accuracy (0.25‰) but are limited in range for salinity. Only four samples (measured at salinities of 0, 27.8, 33.6 and 37.9 ‰) were measured at various temperatures without including points at intermediate low salinities. The data of Murray and Riley (5) cover wide temperature and salinity ranges (1 to 35°C, 0 to 39.1 ‰ S) and agree with the results of Douglas to generally within 0.5 % for pure water and for seawater near 35 ‰ salinity. However, it is pointed out by Weiss (6) that at lower salinities the data of Murray and Riley are lower than the Setchenow fit to Douglas' data (7) by as much as 2.3 %.

Although Murray and Riley (5) claimed a precision of 0.13 %, they were only able to fit the data to "better than 0.7 %". This apparent discrepancy led Weiss (6) to critically evaluate their data and come to the conclusion that their measurements are in error for seawater in the low salinity range. The reanalysis of Murray and Riley's data in this study confirms that conclusion. The Murray and Riley data require high order salinity and temperature terms to fit the data when the low salinity (<18 ‰) solubility values, excluding pure water, are included. This does not seem to be reasonable in view of the simplicity of the equations used to represent the data over wide temperature and salinity ranges for other gases (6-9).

In order to confirm his findings, Weiss (6) made the argon solubility measurements in waters of low salinity using two independent techniques. Both sets of his results agree with the Setchenow treatment of Douglas' data (7) and do not support the data of Murray and Riley (5).

Since the solubility data of Douglas (3,4), Weiss (6) and Murray and Riley (5) are similar in precision, they are combined to form the data base for this study. However, the data of Murray and Riley at salinities below 18 ‰ (except for pure water) are excluded since the available evidences all indicate that they are in error. The following equation is used to represent the Bunsen Solubility Coefficient with a standard deviation of 8.3×10^{-5} units (∿0.25 %)

$$\ln C = -686.1811 + 21561.99/T + 115.5947 \ln T - 0.161717\ T$$
$$+ S(5.887 \times 10^{-3} - 3.4803/T)$$

where C is the Bunsen Solubility Coefficient, T is the absolute temperature.

It should be pointed out that neither Douglas (3,4) nor Murray and Riley (5) corrected their data for the gas dissolution effect on the volume of the aqueous phase (7). Although their original experimental data have been compiled in this study, the corrected values are used in the least squares fit. The correction (Δ) is made according to the following equation (Weiss, personal communication, 1979)

$$\Delta = \frac{273.15\phi_V}{22400\ T}$$

In the present study, partial molar volume of argon (ϕ_V) in water is taken as 32.2 cm^3/mol (10) and 1 mole of argon is considered as occupying 22400 ml in volume at STP.

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. Seawater	Chen-Tung A. Chen School of Oceanography Oregon State University Corvallis OR 97331 June 1979

CRITICAL EVALUATION:

For practical oceanographic purposes, it is convenient to use an equation for the argon solubilities from water-saturated air at 1 atm total pressure in ml (STP)/l as a function of salinity and temperature (7, 11, 12). To take full advantage of the precision of the data it is also desirable to express the solubility unit in terms of μmol/kg, since it is pressure and temperature independent (7, 11, 12). Consequently, the combined data sets have also been fit to the following equations

$$\ln C\ (\mathrm{ml/l}) = -1304.2075 + 36686.68/T + 226.1517 \ln T - 0.364328\ T$$

$$+ S(6.118 \times 10^{-3} - 3.5438/T) \qquad (\pm\ 7.6 \times 10^{-4}\ \mathrm{ml/l})$$

$$\ln C\ (\mu\mathrm{mol/kg}) = -1313.7070 + 37125.99/T + 228.3402 \ln T - 0.366478\ T$$

$$+ S(5.855 \times 10^{-3} - 3.6872/T) \qquad (\pm\ 0.033\ \mu\mathrm{mol/kg})$$

The vapor pressures for pure and seawater have been calculated using the formula given by Besley and Bottomley (13) and by Robinson (14), respectively. The densities have been calculated using the equation of Millero, Gonzalez and Ward (15).

It is worthwhile to point out that the solubility measurements discussed above have all been carried out at argon partial pressures of the order of 1 atm. The results are then applied to use at the normal atmospheric equilibrium pressure of argon (∿0.934 %) by assuming that the Henry's law is valid (16). A few unpublished, preliminary mass spectrometric measurements at normal atmospheric equilibrium concentrations (16), however, give values on the average 1.5 % too high as compared to the above data. More carefully designed and executed experiments will be needed to resolve the above discrepancy.

1. Rakestraw, N. W.; Emmel, V. M. *J. Phys. Chem.* 1938, *42*, 1211-1215.
2. König, V. H. *Z. Naturforsch* 1963, *18*9, 363-367.
3. Douglas, E. *J. Phys. Chem.* 1964, *68*, 169-174.
4. Douglas, E. *J. Phys. Chem.* 1965, *69*, 2608-2610.
5. Murray, C. N.; Riley, J. P. *Deep-Sea Res.* 1970, *17*, 203-209.
6. Weiss, R. F. *Deep-Sea Res.* 1971, *18*, 225-230.
7. Weiss, R. F. *Deep-Sea Res.* 1970, *17*, 721- 735.
8. Chen, C. T.; Carpenter, J. H. 1978, unpublished manuscript.
9. Chen, C. T. in "Oxygen and Ozone (Gas Solubilities)" R. Battino Ed. Pergamon, 1979.
10. Enns, T.; Scholander, P. F.; Bradstreet, E. D. *J. Phys. Chem.* 1965, *69*, 389-391.
11. Craig, H.; Weiss, R. F. *Earth Planet. Sci. Lett.* 1968, *5*, 175-183.
12. Kester, D.in "Chemical Oceanography" v. 1 2nd Edition J. P. Riley and G. Skirrow, eds. Academic Press 1975.
13. Besley, L.; Bottomley, G. A. *J. Chem. Thermodynamics* , 1973, *5*, 397-410.
14. Robinson, R. A. *J. Mar. Biol. Ass. U.K.*, 1954, *33*, 449-455.
15. Millero, F. J.; Gonzalez, A.; Ward, G. K. *J. Mar. Res.* 1976, *34*, 61-93.
16. Bieri, R. H., in "The Sea", v. 5, E. D. Goldberg ed. Wiley-Interscience, 1974.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Seawater

ORIGINAL MEASUREMENTS:

Douglas, E.

<u>J</u>. <u>Phys</u>. <u>Chem</u>. 1964, <u>68</u>, 169 - 174.
<u>J</u>. <u>Phys</u>. <u>Chem</u>. 1965, <u>69</u>, 2608 - 2610.

EXPERIMENTAL VALUES:

Experimental Bunsen Coefficient

Chlorinity/‰ = 0.0

Temperature/K

	277.77	283.15	288.19	293.15	298.35	302.85
	0.04744	0.04178	0.03746	0.03407	0.03111	0.02895
	0.04741	0.04169	0.03749	0.03399	0.03115	0.02907
	0.04748	0.04182	0.03753	0.03407	0.03112	0.02900
	0.04749	0.04182	0.03750	0.03405	0.03115	0.02898
	0.04747	0.04189	0.03751	0.03408	0.03114	0.02905
Av.	0.04746	0.04180	0.03750	0.03405	0.03113	0.02901

Chlorinity/‰ = 15.376

Temperature/K

	274.65	279.61	283.15	287.95	293.14	298.16	302.98
	0.04246	0.03780	0.03493	0.03180	0.02891	0.02668	0.02487
	0.04246	0.03797	0.03487	0.03162	0.02894	0.02666	0.02473
	0.04252	0.03775	0.03499	0.03170	0.02889	0.02662	0.02483
Av.	0.04248	0.03784	0.03493	0.03171	0.02891	0.02665	0.02481

Chlorinity/‰ = 18.604

Temperature/K

	275.32	279.95	283.40	287.86	293.61	298.42	302.87
	0.04019	0.03601	0.03342	0.03066	0.02770	0.02567	0.02413
	0.04020	0.03626	0.03346	0.03065	0.02772	0.02567	0.02412
	0.04023	0.03619	0.03343	0.03060	0.02769	0.02563	0.02405
Av.	0.04021	0.03615	0.03344	0.03064	0.02770	0.02566	0.02410

Chlorinity/‰ = 20.985

Temperature/K

	275.25	279.07	283.30	288.20	293.65	298.03	303.14
	0.03919	0.03583	0.03267	0.02970	0.02702	0.02512	0.02342
	0.03910	0.03574	0.03273	0.02963	0.02701	0.02514	0.02344
	0.03906	0.03582	0.03266	0.02968	0.02702	0.02517	0.02343
Av.	0.03912	0.03580	0.03269	0.02967	0.02702	0.02514	0.02343

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Seawater

ORIGINAL MEASUREMENTS:

Douglas, E.

J. Phys. Chem. 1964, 68, 169-174.
J. Phys. Chem. 1965, 69, 2608-2610.

VARIABLES:

T/K: 274.65 - 303.14
P/kPa: 101.325 (1 atm)
Chlorinity/‰: 0 - 20.985

PREPARED BY:

Chen-Tung A. Chen

EXPERIMENTAL VALUES:

See preceeding page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Microgasometric method: gas-free seawater is brought into contact with pure argon and after equilibration under constant temperature, the amount of gas absorbed by the seawater is measured volumetrically with a micrometer buret. The ratio of the volume of argon absorbed to the volume of seawater gives the solubility coefficient.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Pure argon with less than 0.1% nitrogen and less than 0.01% CO_2.

ESTIMATED ERROR:

$\delta Cl/‰ = 0.05$
$\delta T/K = 0.01$
$\delta \alpha/\alpha = 0.0025$

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Seawater

ORIGINAL MEASUREMENTS:

Murray, C. N.; Riley, J. P.

Deep-Sea Res. 1970, 17, 203-209.

VARIABLES:

T/K: 274.20 - 308.15
Total P/kPa: 101.325 (1 atm)
Salinity/‰: 0 - 39.108

PREPARED BY:

Chen-Tung A. Chen

EXPERIMENTAL VALUES:

Temp/k	Salinity (‰)	Bunsen Coefficient $\alpha \times 10^3$	Temp/k	Salinity (‰)	Bunsen Coefficient $\alpha \times 10^3$
274.20	0.000	52.045	293.22	0.000	34.030
	8.913	48.629		7.553	32.056
	22.484	44.532		18.740	30.234
	22.891	44.506		31.668	28.132
	36.321	40.471		36.258	27.247
278.15	0.000	46.812	298.15	0.000	31.258
	7.599	44.615		14.329	28.331
	17.188	42.060		15.116	28.318
	27.005	39.266		27.460	26.520
	33.765	37.572		31.324	26.057
283.15	0.000	41.655	303.23	0.000	28.874
	10.058	38.668		5.362	27.378
	19.608	36.714		8.528	26.940
	24.403	35.618		15.496	26.003
	33.765	33.571		37.933	23.110
288.15	0.000	37.478	308.15	0.000	26.912
	10.761	34.808		7.435	25.477
	17.944	33.437		19.450	23.960
	25.324	32.051		27.874	23.070
	39.108	29.298		36.143	22.150

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gasometric method: measures the volume of water-saturated argon absorbed by the vacuum degassed seawater in an equilibrium chamber, which is controlled under constant temperature, volume and pressure. The ratio of the volume of argon absorbed to the volume of seawater (measured by weight) gives the solubility coefficient.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Pure argon with stated purity of 99.99% supplied by the British Oxygen Company; mass spectrometry showed the total impurity content to be below 0.02 %.
2. Seawater. Natural surface seawater. Seawaters of various salinities were made by dilution with distilled water or by evaporation.

ESTIMATED ERROR:

$\delta S/‰ = 0.02$
$\delta T/K = 0.015$
δAr = 0.13% in precision and smaller than 0.02×10^{-3} Bunsen coefficient units in accuracy (<0.1%)

REFERENCES:

1. Murray, C. N.; Riley, J. P.; Wilson, T. R. S. *Deep-Sea Res.* 1969, 16, 297-310.
2. Murray, C. N.; Riley, J. P. *Deep-Sea Res.* 1969, 16, 311-320.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Seawater

ORIGINAL MEASUREMENTS:

Weiss, R. F.

Deep-Sea Res., 1971, 18, 225-230.

VARIABLES:

T/K: 278.22 - 298.21
P/kPa: 101.325 (1 atm)
Salinity/‰: 0 - 36.425

PREPARED BY:

Chen-Tung A. Chen

EXPERIMENTAL VALUES:

	Bunsen solubility coefficients		
Salinity/‰	0	11.535	11.535
T/K	298.18	283.31	298.21
Bunsen Coefficient	0.03115[b]	0.03870[a]	0.02929[a]
	0.03132	0.03878	0.02925
	0.03105	0.03872	0.02927
Average	0.03117	0.03873	0.02927

	Bunsen solubility coefficients		
Salinity/‰	11.535	36.425	36.425
T/K	298.18	278.22	298.18
Bunsen Coefficient	0.02914[b]	0.03690[a]	0.02530[b]
	0.02924	0.03688	0.02541
	0.02922	0.03698	0.02537
Average	0.02920	0.03692	0.02536

a. microgasometric results

b. gas chromatographic results

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

a. Microgasometric method: measures the volume of water-saturated argon absorbed by the vacuum-degassed seawater in an equilibrium chamber, which is controlled under constant volume and temperature at 1 atm. The ratio of the volume of the argon absorbed to the volume of seawater gives the solubility coefficient.

b. Gas chromatographic method: uses helium carrier gas to strip the gases in sample. Argon peak separation was achieved using a molecular sieve. Peaks were detected by thermal conductivity and their areas determined by means of a Disc integrator.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Pure argon with specified purity of >99.99% supplied by Air Reduction; gas chromatographic checks showed $\leq 0.01\%$ air contamination.
2. Seawaters of various salinities were made by dilution with distilled water or by evaporation using infrared heating.

ESTIMATED ERROR:

$\delta S/‰ = 0.004$
$\delta T/K = 0.01$
δAr(microgasometric) = 0.2% (2σ);
δAr(GC) = 0.6% (2σ) in precision;
1% in accuracy.

REFERENCES:

1. Weiss, R. F.
   J. Chem. Eng. Data 1971, 16, 235 - 241.

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. Water; H_2O; 7732-18-5 3. Electrolyte (4. Polar Organic Component)	H. L. Clever Department of Chemistry Emory University Atlanta, GA 30322 U. S. A. July 1979

CRITICAL EVALUATION:

The effect of electrolytes on the solubility of argon in water, water-d_2, organic and mixed solvents has been measured by workers in about ten laboratories. It is difficult to compare results from the many laboratories because there is no common agreement among them on the best units to report solubility values and salt-effect parameters. The electrolyte concentrations are reported in units of mole salt dm^{-3} solution, mole salt kg^{-1} solvent, or mole salt (55.51 mole solvent)$^{-1}$. The argon solubility values are reported as Bunsen coefficients, Ostwald coefficients, mole fraction (treating each ion as a species in solution), or cm^3 argon at standard conditions and 101.325 kPa (1 atm) pressure (55.51 mole solvent)$^{-1}$. The last unit is the solvomolality unit in current use in some of the Russian salt effect work.

To carry out an effective evaluation the salt effect data needs to be expressed in the same units. For the evaluation of the salt effects on the other noble gases all of the electrolyte concentrations were converted to mole salt kg^{-1} solvent and the gas solubility values in pure solvent and salt solutions were converted to mole fraction. A salting-out parameter, $k_{sx} = (1/m) \log (X°/X)$, was calculated and compared. To carry out the same calculations for the argon solubilities proved to be a too time consuming project to complete before the deadline for the argon volume. In place of such a comparison, qualitative evaluation comments are given below about each of the laboratories carrying out salt effect work. The argon solubilities in salt solutions are considered tentative unless there are specific comments to the contrary in the section below. Values presented only in graphs are rejected because they are not of quantitative use to the rest of the scientific community.

Abrosimov, Badelin and Krestov (1,2) measured the solubility of argon in both water and water-d_2 solutions of the alkali halides LiCl, NaCl, KCl, RbCl, CsCl, CsBr, NaI, and KI up to concentrations of about 2.5 molal at ten degree intervals from 283.15 to 313.15 K. The salt concentration and the argon solubility are reported in the solvomolality unit which is referenced to 55.51 moles of solvent. When the solvent is ordinary water, the unit is molality for the salt and proportional to the Kuenen coefficient for the gas. For water-d_2 and other solvents there are no comparable units. Abrosimov <u>et al</u>. values of the argon solubility in water agree well with the recommended values, but in water-d_2 the agreement is not quite as good (within 1.5 percent). The data are classed as tentative.

Akerlof (3) was the first to measure the effect of added electrolyte on the solubility of argon. His apparatus and procedure were elaborate but his argon solubility values in water are high. He measured the solubility of argon in about 3 and 6 molal NH_4Cl, LiCl, NaCl, KCl, $MgCl_2$, $CaCl_2$, $SrCl_2$, $BaCl_2$, $AlCl_3$, $HClO_4$, and $NaNO_3$ at 298.15 K. For the alkali halides his values of the salt-effect parameter are usually lower than the values reported by other workers. There is a trend for the salt effect parameter to decrease as salt molality increases. Either that or a systematic error in his method could account for his low results.

Ben-Naim and Egel-Thal (4) measured the solubility of argon in water and 1.0 molal salt solutions of LiCl, NaCl, KCl, KBr, NaI and KI at five degree intervals from 278.15 to 298.15 K. They made measurements at only one salt concentration and applied no correction for solvent evaporation on degassing. Thus their results may not be quite as reliable as when measurements are made at several salt concentrations and the solutions are analyzed after degassing. The data are classed as tentative.

Clever and Holland (5) measured the solubility of argon in aqueous solutions of LiCl and NaI at three temperatures and in aqueous solutions of NaCl, KCl, and NaBr at one temperature. Clever and Reddy (6) measured the solubility of argon in both water + NaI and methanol + NaI at one temperature. Agreement between the Setschenow salt-effect parameters for argon in water + NaI is only fair. The data are classed as tentative.

Conway, Novak and Laliberte (7) measured the solubility of argon at several salt concentrations in aqueous NH_4Br, $(CH_3)_4NBr$, $(C_2H_5)_4NBr$, $(n\text{-}C_3H_7)_4NBr$ and $(n\text{-}C_4H_9)_4NBr$ at 298.15 K. They reported their results as Henry's constant and as mole gas dm^{-3} atm^{-1}. Some of their Henry's constant values appear to be in error (see note on the data sheet). They define a relative salting out constant as $k = \Delta S/S°m$ where ΔS is the difference in the argon solubility between water and salt solution, S° is the solubility in pure water, and m is the salt concentration. They state that the relative salting out constant is consistent with the continuum-distribution treatment of salting out. The data are classed as tentative.

Eucken and Hertzberg (8) measured the solubility of argon in aqueous solutions at 273.15 and 293.15 K. In an earlier evaluation of the argon + water + NaCl system by Clever and Holland (5) there was evidence that their salt effect parameter at 293.15 K is high, but the 273.15 K value is consistent with the data of others.

Masterton, Polizzotti and Wells (20) measured the solubility of argon in the solutions of the aqueous complex ion electrolyte trans-$[Co(en)_2NCSCl]Br$ [15362-24-0] at 298.15 K. The work appears to have been carried out carefully and the data are classified as tentative.

Mishnina, Avdeeva, and Bozhovakaya (21) present a table of smoothed values of argon Bunsen coefficients at 12 concentrations from 0 to 5.4 molal NaCl at five degree intervals from 278.15 to 348.15 K. There is a value of the salting out parameter at each temperature. The experimental data base for the table is not completely clear. Morrison and Johnstone's value is mentioned, as well as some Russian work not available to us. The salt-effect parameters agree reasonably well with values from other sources, see Figure 1 in the paper of Clever and Holland (6).

Morrison and Johnstone (22) measured the salt-effect parameter for argon solubility in aqueous LiCl, NaCl, and KI at 298.15 K. They made measurements at the single salt concentration of one molal. Use of a single salt solution gives their values more uncertainty than the values of others who measured the solubility over a range of concentrations. The data are classified as tentative.

Shoor, Walker, and Gubbins (25) measured the solubility of argon in aqueous KOH up to concentrations of 10.37 molal and at temperatures of 298.15, 313.15, 333.15, and 353.15 K. The authors used a gas chromatographic method of measurement. Chromatographic methods are sometimes not as accurate as volumetric methods. However, this work appears to have been carried out carefully and the data are classed as tentative.

The group of Krestov, Nedel'ko, Abrosimov, Myasoedova, Badelin, Bobrinev, Slyusar and other co-workers of the Ivanovo Chemical Technology Institute, USSR, are very active in the study of the solubility of gases in the presence of added electrolytes. Unfortunately many of their papers were not available to us in time to include in this compilation of data. Of the papers that are available many report the solubility data in only graphical form. Summarized below are the systems on which the Russians have worked, but because of either nonavailability of the paper or only graphical presentation in the paper, no data sheets were prepared.

1. Argon + Water + Water-d_2 + Potassium Chloride

Krestov, Abrosimov, and Strakhov (9) graphically show argon Bunsen coefficients as a function of water-d_2 mole fraction in 0.00, 0.10, 0.30, 1.00 and 2.00 molal KCl at temperatures of 283.38, 292.72, 308.25 and 318.48 K.

2. Argon + Water + Methanol + Potassium Chloride

Provokov, Krestov, Kopov (24) report argon solubility data on this system. The paper was not available.

3. Argon + Water + Ethanol + Potassium Chloride

Krestov, Nedel'ko, Bobrinov, Kuvanova and Zakharova (16) report argon solubility data on the system and on the mixed solvent system with other electrolytes. The paper was not available.

4. Argon + Water + 2-Methyl-2-propanol + Potassium Chloride

Krestov, Nedel'ko, and Slyusar (18, 19) report on the solubility and thermodynamics of argon dissolution in the system in two deposited documents. The data extend over the 293 to 313 K temperature range. The papers have not arrived in time to be compiled.

5. Argon + Water + 2-Propanone + Electrolytes

Krestov, Nedel'ko, and Myasoedova have published three papers on these systems. They report (10) the solubility of argon in solutions at 0.00, 0.05, 0.09, 0.17, 0.25, 0.33, 0.49, and 0.60 mole fraction 2-propanone from 0 to 4 molal KCl at temperatures of 288.15, 298.15, 303.15 and 313.15 K. The data are on small scale graphs, no data sheets were prepared. They also report the solubility of argon in the mixed solvent up to an 2-propanone mole fraction of 0.331 and containing LiCl, NaCl, KCl, KBr, KI, RbCl or CsCl at concentrations up to 4 molal. Most of the data are at a temperature of 298.15 K but some is over the 288.15 to 313.15 K temperature interval. The data are on small scale graphs and no data sheets were prepared. In a deposited document (17) they report data up to 0.331 mole fraction 2-propanone, up to saturated solutions of LiCl, NaCl, KBr, and KI at 298.15 K. We do not have a copy of the document and no data sheets were prepared.

6. Argon + Water + Dimethylformamide + Electrolytes

Krestov, Nedel'ko, and Polishchuk (11) show graphs of the argon Bunsen coefficient up to dimethylformamide concentrations of 0.4 mole fraction at 0.00, 0.05, 0.2, 0.3, and 0.4 molal LiCl, NaCl, KCl or CsCl at 298.15 K. No data sheets were prepared.

7. Argon + Water + Transition metal tetrasulfophthalocyanine complexes

Nedel'ko, Krestov, Al'yanov, Borodkin, Golyand and Maizlish (23) report the solubility and thermodynamic parameters of dissolution in the system. The paper was not available and no data sheets were prepared.

In addition to the papers discussed above the Ivanovo Chemical Technology Institute group has published several general papers (13, 14, 15) on the solubility of gases in aqueous electrolyte solutions.

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1. Abrosimov, V. K.; Badelin, V. G.; Krestov, G. A. Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1976, 19, 1381.
2. Abrosimov, V. K.; Badelin, V. G.; Krestov, G. A. Ibid. 1977, 20, 1864.
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10. Krestov, G. A.; Nedel'ko, B. E.; Myasoedova, V. V. Ibid 1975, 18, 753.
11. Krestov, G. A.; Nedel'ko, B. E.; Polishchuk, A. P. Ibid 1975, 18, 1590.
12. Krestov, G. A.; Nedel'ko. B. E.; Myasoedova, V. V. Ibid 1977, 20, 934.
13. Krestov, G. A.; Nedel'ko, B. E.; Bobrinev, Yu. M.; Kuvanova, N. I. Izbr. Dokl. Nauch.-Tekh. Konf., Ivanov. Khim. Tekhnol. Inst. 1973, 19; Chem. Abstr. 1974, 81, 42361w.
14. Krestov, G. A.; Nedel'ko, B. E. Tr. Ivanov. Khim. Tekhnol. Inst. 1975, No. 13, 32; Chem. Abstr. 1973, 78, 164855u.

15. Krestov, G. A.; Nedel'ko, B. E. Ibid 1973, No. 15, 38; Chem. Abstr. 1974, 81, 159665q.

16. Krestov, G. A.; Nedel'ko, B. E.; Bobrinev, Yu. M.; Kuvanova, N. I.; Zakharova, O. V. Ibid 1973, No. 16, 141; Chem. Abstr. 1975, 82, 145884n.

17. Krestov, G. A.; Myasoedova, V. V.; Nedel'ko. B. E. Deposited Doc. 1977, VINITI No. 349-77, 11 pp; Chem. Abstr. 1979, 90, 128406n.

18. Krestov, G. A.; Nedel'ko, B. E.; Slyusar, V. P. Deposited Doc. 1976, VINITI No. 3946-76, 11 pp; Chem. Abstr. 1978, 89, 118725f.

19. Krestov, G. A.; Nedel'ko, B. E.; Slyusar, V. P. Deposited Doc. 1976, VINITI No. 4428-76, 9 pp; Chem. Abstr. 1979, 90, 110730d.

20. Masterton, W. L.; Polizzotti, D.; Wells, H. J. Soln. Chem. 1973, 2, 417.

21. Mishnina, T. A.; Avdeeva, O. I.; Bozhovakaya, T. K. Materialy Vses. Nauchn. Issled. Geol. Inst. 1961, 46, 93.

22. Morrison, T. J.; Johnstone, N. B. B. J. Chem. Soc, 1955, 3655.

23. Nedel'ko, B. E.; Krestov. G. A.; Al'yanov, M. I.; Borodkin, V. F.; Golyand, S. M.; Maizlish, V. E. Tr. Ivanov. Khim.-Tekhnol. Inst. 1974, No. 15, 75; Chem. Abstr. 1974, 81, 141756k.

24. Prorokov, G. A.; Krestov, G. A.; Kopov, V. I. Termodinamika I. Stroenie Rastvorov 1976,(5), 88; Chem. Abstr. 1977, 86, 178389x.

25. Shoor, S. K.; Walker, R. D. Jr.; Gubbins, K. E. J. Phys. Chem. 1969, 73, 312.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Perchloric Acid; $HClO_4$; 7601-90-3

ORIGINAL MEASUREMENTS:

Akerlof, G.

J. Am. Chem. Soc. 1935, *57*, 1196-1201.

VARIABLES:

T/K: 298.15
P/kPa: 101.325 (1 atm)
Salt/mol kg^{-1} H_2O: 0 - 9.32

PREPARED BY:

T. D. Kittredge
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Electrolyte Mol kg^{-1} H_2O	Argon Solubility dm^3 Ar (STP) kg^{-1} H_2O	Salt Effect Parameters $k_s = (1/m)\log(S°/S)$	$k_{sx} = (1/m)\log(X°/X)$
298.15	0.00	0.0332	-	-
	4.05	0.0411	-0.023	-0.008
	9.32	0.0521	-0.021	-0.008

The compiler calculated the salt effect parameters on a molality basis.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Gas absorption method. The solution was prepared and its concentration calculated from the measured density (Mohr-Westphal balance) and density tables in the International Critical Tables (Vol. III). The solution was degassed by heating, then boiling in a vacuum for 45 minutes.

The argon was presaturated with water vapor from the solution. The solution volume was measured by displacement of an equivalent volume of mercury as the gas and solution were brought into contact. The gas-liquid interface, of relatively large area, was gently stirred for two hours, although equilibrium appeared to be established within a matter of minutes. The decrease in gas volume due to solution was measured on the attached buret system.

The solubility values were reported as dm^3 Ar (STP) kg^{-1} water. This is equivalent to the Kuenen coefficient when water alone is the solvent.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Source not given. Stated to be 99 per cent argon with most of the impurity nitrogen.
2. Water. No information.
3. Electrolyte. Source not given. Stated to be of the "Analyzed variety".

ESTIMATED ERROR:

$\delta T/K = 0.01$
$\delta S/S = 0.01$ (author)

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Ammonium Chloride; NH_4Cl; 12125-02-9

ORIGINAL MEASUREMENTS:

Ben-Naim, A.; Egel-Thal, M.

J. Phys. Chem. 1965, 69, 3250-3253.

VARIABLES:

T/K: 278.15 - 298.15
Total P/kPa: 101.325 (1 atm)
Salt/mol kg^{-1} H_2O: 0 - 1

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Electrolyte mol kg^{-1} H_2O	Ostwald Coefficient $L \times 10^3$	Salt Effect Parameter $k_s = (1/m)\log(L^o/L)$
278.15	0.0	48.07	-
	1.0	38.20	0.100
283.15	0.0	43.36	-
	1.0	34.91	0.094
288.15	0.0	39.56	-
	1.0	32.23	0.089
293.15	0.0	36.63	-
	1.0	30.08	0.086
298.15	0.0	34.08	-
	1.0	28.27	0.081

The solubility values are the average of two to three measurements.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus of Ben-Naim and Baer (1) is used. There is a calibrated dissolution vessel which contains the degassed solvent. The gas is introduced wet from a gas buret. Stirring forces the liquid through the gas. The amount of gas dissolved is measured on a gas buret.

The entire apparatus is immersed in a water thermostat.

During outgassing a small change in salt concentration may occur. No correction for this is made.

SOURCE AND PURITY OF MATERIALS:

1. Argon. No source given.
2. Water. Distilled.
3. Ammonium Chloride. Analar grade.

ESTIMATED ERROR:

$\delta m/m = 0.01$

Overall apparatus precision ± 0.2% (authors)

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Ammonium Bromide; NH_4Br; 12124-97-9; and some N,N,N-Trialkyl alkanaminium Bromides

ORIGINAL MEASUREMENTS:

Conway, B. E.; Novak, D. M.; Laliberte, L.

J. Solution Chem. 1974, 3, 683 - 711.

EXPERIMENTAL VALUES:

T/K	Electrolyte mol dm^{-3}	Argon Solubility: Henry's Constant mol dm^{-3} $(mmHg)^{-1}$ x 10^6	Argon Solubility: mol dm^{-3} atm^{-1} x 10^3	Salt Effect Parameter: k_s*** = $\Delta S/S^om$	Salt Effect Parameter: k_s = (1/C) log C^o/C
Ammonium Bromide; NH_4Br; 12124-97-9					
298.15	0.0	-	1.31	-	-
	0.25	8.88*	1.32	-0.075**	-0.013
	0.50	8.93*	1.33	-0.076**	-0.013
	1.00	9.41*	1.45	-0.158**	-0.044
	2.00	9.85*	1.47	-0.115**	-0.025
N,N,N-Trimethylmethanaminium Bromide or Tetramethyl ammonium Bromide; $(CH_3)_4NBr$; 64-20-0					
298.15	0.0	1.72	1.31	-	-
	0.25	1.70	1.29	-0.055	0.027
	0.50	1.67	1.27	-0.052	0.027
	1.00	1.62	1.23	-0.058	0.027
	1.50	1.55	1.18	-0.057	0.030
	2.00	1.32	1.00	0.019	0.059
	3.00	0.74	0.56	0.116	0.123
N,N,N-Triethylethanaminium Bromide; $(C_2H_5)_4NBr$; 71-91-0					
298.15	0.0	1.72	1.31	-	-
	0.25	1.68	1.28	-0.049	0.040
	0.50	1.52	1.16	0.045	0.106
	1.00	1.13	0.85	0.202	0.188
	1.50	0.79	0.61	0.189	0.221
	2.00	0.71	0.54	0.107	0.192
	2.50	0.70	0.55	-	0.151
	3.00	0.88	0.67	-0.020	0.097
N,N,N-Tripropylpropanaminium Bromide; $(C_3H_7)_4NBr$; 1941-30-6					
298.15	0.0	1.72	1.31	-	-
	0.20	1.68	1.27	0.08	0.067
	0.30	1.62	1.23	-0.041	0.091
	0.50	1.02	0.77	-0.659	0.462
	1.00	0.76	0.59	0.408	0.346
	1.50	0.81	0.61	0.189	0.221
N,N,N-Tributyl-1-butanaminium Bromide; $(C_4H_9)_4NBr$; 1643-19-2					
298.15	0.0	-	1.31	-	-
	0.20	8.29*	1.25	-0.069	0.102
	0.30	4.14*	0.63	1.58	1.06
	0.50	4.36*	0.67	0.80	0.58
	0.75	6.13*	0.94	0.10	0.19

* These values do not appear to be consistent with the Henry's law constants for the other salts. The values for the other salts appear to be the mol dm^{-3} atm^{-1} values divided by 760 mmHg atm^{-1}. An error is suspected. These may be K_H' instead of K_H values (see method below).

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Argon; Ar; 7440-37-1 2. Water; H_2O; 7732-18-5 3. Ammonium Bromide; NH_4Br; 12124-97-9; and some N,N,N-Trialkyl alkanaminium Bromides	Conway, B. E.; Novak, D. M.; Laliberte, L. J. Solution Chem. 1974, 3, 683 - 711.
VARIABLES: T/K: 298.15 Total P/kPa: 76.66 - 101.325 (595 - 760 mmHg) Salt/mol dm^{-3}: 0 - 3.00	PREPARED BY: H. L. Clever P. L. Long

EXPERIMENTAL VALUES: See preceeding page.

** The values for NH_4Br were not given in the paper. The compiler calculated these from the partial molal volume of 43.9 cm^3 mol^{-1} given in the paper. The values do not agree with the values shown in Fig. 4 of the paper. However, we were able to reproduce the relative salting out values for the other salts.

*** The authors calculate the relative salting out, $k_s = \Delta S/S^o m$, which they state to be consistent with the continuum-distribution treatment of salting out. The values of the argon solubility change between water and salt solution and the solubility in water and the salt concentration are calculated for an amount of solution containing one dm^3 of water. Values of the argon solubility and the salt concentration in the table were converted to the dm^{-3} water basis by means of the partial molal volumes at infinite dilution of the electrolytes in water. The values used are 43.9, 114.2, 174.2, 239.6 and 301.0 cm^3 mol^{-1} for NH_4Br to $(C_4H_9)_4NBr$ respectively.

The compiler has added a conventional salting effect parameter, $k_s = (1/C)\log(C^o/C)$, for use in comparing the present results with the results of other workers.

In the equation above the first C is the salt concentration in units of mol dm^{-3}. The C^o/C term is the argon solubility ratio with the C's in units of mol Ar dm^{-3} solution. The C^o represents the pure water argon solubility value.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method is based on the principle employed in volumeteric adsorption studies on high area porus materials where the apparent PV relation for a given initial amount of gas is determined as a function of pressure. An advantage of the method is that is precludes the necessity of vacuum-outgassing the liquid phase. The apparatus is described by Novak and Conway (1).

The apparatus consists of a flask that hold 500 cm^{-3} of liquid solvent and a gas buret. There is a reference manometer, which is independent of atm pressure. The solvent is roughly degassed on a water pump. The gas under study is bubbled through to force out any remaining gas. The system is stirred until equilibrium is reached and the final pressure and volume are taken. The pressure is changed and equilibrium attained again, the procedure is repeated 6 to 10 times over the pressure range of about 575 to 760 mmHg. The slope of the $(PV)_{Ar}$ vs P_{Ar} is $-K'_H RT$. The standard K_H is obtained from K'_H.

SOURCE AND PURITY OF MATERIALS:

1. Argon. No information.
2. Water. Double distilled.
3. Salts. The purification, drying and analysis followed previously described procedures (2).

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta L/L = 0.025$

REFERENCES:

1. Novak, D. M.; Conway, B. E. Chem. Instr. 1973, 5, 79.
2. Conway, B. E.; Verrall, R. E.; Desnoyers, J. E. Trans. Faraday Soc. 1965, 62, 2738.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Argon; Ar; 7440-37-1 2. Water; H_2O; 7732-18-5 3. trans-Chloroisothiocyanatobis-(ethylenediamine)cobalt(III) bromide; trans-$[Co(en)_2NCSCl]Br$; 15362-24-0	Masterton, W. L.; Polizzotti, D.; Welles, H. J. Solution Chem. 1973, 2, 417 - 423.
VARIABLES:	PREPARED BY:
T/K: 298.15 P/kPa: 101.325 (1 atm) Salt/mol dm^{-3} : 0 - 0.270	H. L. Clever

EXPERIMENTAL VALUES:

T/K	Electrolyte mol dm^{-3}	Solution Density g cm^{-3}	Argon Solubility mol dm^{-3} x 10^3	Solubility Ratio Mol Fraction Ar in H_2O/Ar in Sol'n. X^o/X
298.15	0.0	0.9971	1.396	1.000
	0.097	1.0129	1.281	1.073
	0.204	1.0303	1.152	1.174
	0.270	1.0410	1.086	1.233

The salt effect parameter is $k_{SX} = (1/C) \log (X^o/X) = (0.33_6 \pm 0.009)$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solubilities were determined by measuring the volume of gas dissolved in a known volume of solvent. The apparatus was similar to that described by Wen and Hung (1). The dissolution cell was fitted with three capillary pipets, which made it possible to accurately measure the solvent volume change as the argon dissolved. The volume of gas dissolved can be measured to ± 0.01 cm^3 in a system of gas burets with auxillary bulbs. Six to twelve hours were required to ensure achievement of equilibrium.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Inc. Stated purity of 99.998 % Ar.
2. Water. Distilled, passed through ion exchange column. Specific conductivity 10^{-6} $(ohm\text{-}cm)^{-1}$.
3. trans-$[Co(en)_2NCSCl]Br$. Prepared by method of Schlessinger, G. G. See Inorganic Laboratory Preparations, Chemical Publishing Co.,Inc. New York, 1962, page 240.

ESTIMATED ERROR:

$\delta T/K = 0.02$
$\delta P/mmHg = 3$
$\delta \Delta V/cm^3 = 0.01$

REFERENCES:

1. Wen, W.-Y.; Hung, J. H. J. Phys. Chem. 1970, 74, 170.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Aluminum Chloride; $AlCl_3$; 7446-70-0

ORIGINAL MEASUREMENTS:

Akerlof, G.

J. Am. Chem. Soc. 1935, 57, 1196-1201.

VARIABLES:

T/K: 298.15
P/kPa: 101.325 (1 atm)
Salt/mol kg^{-1} H_2O: 0 - 1.56

PREPARED BY:

T. D. Kittredge
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Electrolyte Mol kg^{-1} H_2O	Argon Solubility dm^3 Ar (STP) kg^{-1} H_2O	Salt Effect Parameters	
			$k_S=(1/m)\log(S°/S)$	$k_{SX}=(1/m)\log(X°/X)$
298.15	0.00	0.0332	-	-
	0.98	0.0247	0.131	0.161
	1.56	0.0179	0.172	0.202

The compiler calculated the salt effect parameters on a molality basis.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas absorption method. The solution was prepared and its concentration calculated from the measured density (Mohr-Westphal balance) and density tables in the International Critical Tables (Vol. III). The solution was degassed by heating, then boiling in a vacuum for 45 minutes.

The argon was presaturated with water vapor from the solution. The solution volume was measured by displacement of an equivalent volume of mercury as the gas and solution were brought into contact. The gas-liquid interface, of relatively large area, was gently stirred for two hours, although equilibrium appeared to be established within a matter of minutes. The decrease in gas volume do to solution was measured on the attached buret system.

The solubility values were reported as dm^3 Ar (STP) kg^{-1} water. This is equivalent to the Kuenen coefficient when water alone is the solvent.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Source not given. Stated to be 99 per cent argon with most of the impurity nitrogen.
2. Water. No information.
3. Electrolyte. Source not given. Stated to be of the "analyzed variety".

ESTIMATED ERROR:

$\delta T/K = 0.01$
$\delta S/S = 0.01$ (author)

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Alkaline Earth Metal Chlorides

ORIGINAL MEASUREMENTS:

Akerlof, G.

<u>J</u>. <u>Am</u>. <u>Chem</u>. <u>Soc</u>. 1935, <u>57</u>, 1196-1201.

VARIABLES:

T/K: 298.15
P/kPa: 101.325 (1 atm)
Salt/mol kg^{-1} H_2O: 0 - 5.37

PREPARED BY:

T. D. Kittredge
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Electrolyte Mol kg^{-1} H_2O	Argon Solubility dm^3 Ar (STP) kg^{-1} H_2O	Salt Effect Parameters $k_s=(1/m)\log(S^o/S)$	$k_{sX}=(1/m)\log(X^o/X$
Magnesium chloride; $MgCl_2$; 7786-30-3				
298.15	0.00	0.0332	-	-
	3.02	0.0248	0.042	0.064
	5.02	0.0228	0.033	0.053
Calcium Chloride; $CaCl_2$; 10043-52-4				
298.15	0.00	0.0332	-	-
	2.95	0.0216	0.063	0.085
	5.37	0.0180	0.050	0.070
Strontium Chloride; $SrCl_2$; 10476-85-4				
298.15	0.00	0.0332	-	-
	2.10	0.0203	0.102	0.124
	3.56	0.0150	0.097	0.118
Barium Chloride; $BaCl_2$; 10361-37-2				
298.15	0.00	0.0332	-	-
	1.25	0.0185	0.203	0.226
	1.74	0.0141	0.214	0.236

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas absorption method. The solution was prepared and its concentration calculated from the measured density (Mohr-Westphal balance) and density tables in the International Critical Tables (Vol. III). The solution was degassed by heating, then boiling in vacuum for 45 minutes.

The argon gas was presaturated with solution water vapor. The solution volume was measured by displacement of an equivalent volume of mercury as the gas and solution were brought into contact. The gas-liquid interface, of relatively large area, was gently stirred for two hours, although equilibrium appeared to be established within a few minutes. The decrease in gas volume was measured on the attached buret system.

The solubility value in water is equivalent to a Kuenen coefficient. In the electrolyte solutions the solubility is kg^{-1} water.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Source not given. Stated to be 99 per cent argon with most of the impurity nitrogen.
2. Water. No information given.
3. Electrolytes. Sources not given. Stated to be of the "analyzed variety".

ESTIMATED ERROR:

$\delta T/K = 0.01$
$\delta S/S = 0.01$ (author)

The salt effect parameters above are calculated with respect to the electrolyte molality. The authors values were calculated with respect to the electrolyte ionic strength.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Lithium Chloride; LiCl; 7447-41-8

ORIGINAL MEASUREMENTS:

Ben-Naim, A.; Egel-Thal, M.

J. Phys. Chem. 1965, 69, 3250 - 3253.

VARIABLES:

T/K: 278.15 - 298.15
Total P/kPa: 101.325 (1 atm)
Salt/mol kg^{-1} H_2O: 0 - 1

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Electrolyte mol kg^{-1} H_2O	Ostwald Coefficient $L \times 10^3$	Salt Effect Parameter $k_s = (1/m)\log(L^o/L)$
278.15	0.0	48.07	-
	1.0	37.01	0.114
283.15	0.0	43.36	-
	1.0	33.83	0.108
288.15	0.0	39.56	-
	1.0	31.25	0.102
293.15	0.0	36.63	-
	1.0	29.19	0.099
298.15	0.0	34.08	-
	1.0	27.47	0.094

The solubility values are the average of two to three measurements.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The apparatus of Ben-Naim and Baer (1) is used. There is a calibrated dissolution vessel which contains the degassed solvent. The gas is introduced wet from a gas buret. Stirring forces the liquid through the gas. The amount of gas dissolved is measured on a gas buret.

The entire apparatus is immersed in a water thermostat.

During outgassing a small change in salt concentration may occur. No correction for this is made.

SOURCE AND PURITY OF MATERIALS:

1. Argon. No source given.
2. Water. Distilled.
3. Lithium Chloride. Analar grade.

ESTIMATED ERROR:

$\delta m/m = 0.01$
Overall apparatus precision ± 0.2 % (authors)

REFERENCES:

1. Ben-Naim, A.; Baer, S.
Trans. Faraday Soc. 1963, 59, 2735.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Lithium Chloride; LiCl; 7447-41-8

ORIGINAL MEASUREMENTS:

Clever, H. L.; Holland, C. J.

J. Chem. Eng. Data 1968, *13*, 411 -414.

VARIABLES:

T/K: 296.15 - 313.15
P/kPa: 101.325 (1 atm)
LiCl/mol kg^{-1} H_2O: 0 - 2.53

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Electrolyte mol kg^{-1} H_2O	No. of Det'n.	Bunsen Coefficient $\alpha \times 10^3$	Salt Effect Parameters $k_s = (1/C)\log(\alpha^o/\alpha)$	$k_s = (1/m)\log(\alpha^o/\alpha)$
296.15	0.0		32.3	-	-
	0.4186	4	28.5 ± 0.3		0.130
	1.2311	5	23.9 ± 0.3		0.106
	2.5340	3	18.0 ± 0.1		0.100
				0.102 (authors)	0.107 (authors
308.15	0.0	10	26.9 ± 0.5		-
	0.4378	3	24.5 ± 0.2		0.093
	0.6325	6	23.5 ± 0.5		0.064
	1.2581	6	19.9 ± 0.5		0.104
	1.9735	3	17.2 ± 0.2		0.098
				0.099 (authors)	0.102 (authors)
313.15	0.0	4	25.2 ± 0.3		-
	0.4378	3	23.3 ± 0.1		0.078
	0.9986	5	20.6 ± 0.4		0.088
	1.2311	5	18.6 ± 0.3		0.107
	1.2581	4	19.4 ± 0.2		0.090
				0.097 (authors)	0.100 (authors)

The compiler calculated individual values of $k_s = (1/m)\log(\alpha^o/\alpha)$ in the table above. Values of $k_{sX} = (1/m)\log(X^o/X)$ can be obtained by adding 0.015 to the values above.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The apparatus was modeled after that of Markham and Kobe (1). A length of TRUEBORE tubing of 0.4643 cm^2 cross-section was used as the gas buret. The volume of argon, presaturated with the solvent vapor, taken up by a 103.1 cm^3 sample of the solvent was measured.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co. Inc. Stated to be 99.99 % argon.
2. Water. Distilled.
3. Lithium Chloride. Either Merck & Co. or J.T.Baker Co. Composition of the solutions determined by a Volhard titration.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 3$
$\delta\alpha/\alpha = 0.015 - 0.025$

REFERENCES:

1. Markham, A. E.; Kobe, K. A. *J. Am. Chem. Soc.* 1941, *63*, 449.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Lithium Chloride; LiCl; 7447-41-8

ORIGINAL MEASUREMENTS:

Abrosimov, V. K.; Badelin, V. G.
Krestov, G. A.

Izv. Vyssh. Ucheb. Zaved.,Khim. Khim. Tekhnol. 1976, 19, 1381 - 1386.

VARIABLES:

T/K: 283.15 - 313.15
P/kPa: 101.325 (1 atm)
LiCl/mol kg^{-1} H_2O: 0 - 2.3754

PREPARED BY:

A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Lithium Chloride mol kg^{-1} H_2O	Argon Solubility A_{sm}	Salt Effect Parameter $k = (1/C_{sm}) \log (A^o/A)$
283.15	0.0	41.81	-
	0.2309	39.36	0.1136
	0.5704	36.37	0.1061
	0.9524	33.31	0.1036
	1.8825	27.20	0.0992
293.15	0.0	34.21	-
	0.1615	33.06	0.0920
	0.1884	32.92	0.0886
	0.4471	31.24	0.0882
	0.9536	28.11	0.0894
	1.3590	25.92	0.0887
	1.4690	25.29	0.0893
303.15	0.0	29.00	-
	0.1098	28.16	0.1163
	0.1605	27.89	0.1056
	0.3942	26.54	0.0977
	0.8065	24.43	0.0923
	1.3469	22.24	0.0856
	2.2980	18.42	0.0858
313.15	0.0	25.40	-
	0.1415	25.00	0.0487
	0.6324	22.73	0.0763
	1.2686	20.18	0.0788
	1.6011	18.99	0.0789
	2.3751	16.57	0.0781

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure were presumably based on those described by Ben-Naim and Baer (1).

The authors define the solubility of argon, A_{sm}, as

$$A_{sm} = \frac{v°(55.51M_{r,1} + C_{sm}M_{r,2})}{v_{p-p}\ 1000\ \rho_{p-p}}$$

where v° = ml Ar at 101.325 kPa and standard conditions, v_{p-p} = ml solution, ρ_{p-p} = solution density, g ml^{-1}, $M_{r,1}$ and $M_{r,2}$ = water and salt mol weight, respectively, and C_{sm} = salt mol kg^{-1} water (55.51 mol water). The authors also define A_{sm} as ml Ar at 101.325 kPa and standard contitions (55.51 mol $H_2O)^{-1}$, but if that is the definition it appears the 1000 should be deleted from the equation denominator.

SOURCE AND PURITY OF MATERIALS:

No information given.

ESTIMATED ERROR:

$\delta A/A = 0.01$ (Compiler)

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Alkali Metal Chlorides

ORIGINAL MEASUREMENTS:

Akerlof, G.

J. Am. Chem. Soc. 1935, 57,1196-1201.

VARIABLES:

T/K: 298.15
P/kPa: 101.325 (1 atm)
Salt/mol kg^{-1} H_2O: 0 - 6.78

PREPARED BY:

T. D. Kittredge
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Electrolyte Mol kg^{-1} H_2O	Argon Solubility dm^3 Ar kg^{-1} H_2O	Salt Effect Parameters $k_s = (1/m)\log(S^o/S)$	$k_{sX} = (1/m)\log(X^o/X)$
	Lithium chloride; LiCl; 7447-41-8			
298.15	0.00	0.0332	-	-
	3.35	0.0248	0.038	0.053
	6.78	0.0187	0.037	0.051
	Sodium Chloride; NaCl; 7647-14-5			
298.15	0.00	0.0332	-	-
	3.23	0.0216	0.058	0.073
	5.98	0.0149	0.058	0.072
	Potassium Chloride; KCl; 7447-40-7			
298.15	0.00	0.0332	-	-
	3.00	0.0220	0.060	0.074
	4.55	0.0174	0.062	0.076

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas absorption method. The solution was prepared and its concentration calculated from the measured density (Mohr-Westphal balance) and density tables in the International Critical Tables (Vol. III). The solution was degassed by heating, then boiling in a vacuum for 45 minutes.

The argon was presaturated with water vapor from the solution. The solution volume was measured by displacement of an equivalent volume of mercury as the gas and solution were brought into contact. The gas-liquid interface, of relatively large area, was gently stirred for two hours, although equilibrium appeared to be established within a matter of minutes. The decrease in gas volume due to solution was measured on the attached buret system.

The solubility values were reported as dm^3 Ar (STP) kg^{-1} water. This is equivalent to the Kuenen coefficient when water alone is the solvent.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Source not given. Stated to be 99 per cent argon with most of the impurity nitrogen.
2. Water. No information.
3. Electrolytes. Source not given. Stated to be of the "analyzed variety".

ESTIMATED ERROR: $\delta T/K = 0.01$
$\delta S/S = 0.01$ (author)

The salt effect parameters above were calculated from electrolyte molality. The author's values were calculated from electrolyte ionic strength.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Electrolytes

ORIGINAL MEASUREMENTS:

Morrison, T. J.; Johnstone, N. B. B.

J. Chem. Soc. 1955, 3655 - 3659.

VARIABLES:

T/K: 298.15

PREPARED BY:

T. D. Kittredge
March 1978

EXPERIMENTAL VALUES:

T/K	$k_s = (1/m)\log(S°/S)$	$k_{sx} = (1/m)\log(X°/X)$
Lithium Chloride; LiCl; 7447-41-8		
298.15	0.096	0.111
Sodium Chloride; NaCl; 7647-14-5		
298.15	0.133	0.148
Potassium Iodide; KI; 7681-11-0		
298.15	0.108	0.123

AUXILIARY INFORMATION

METHOD:

Gas absorption in a flow system.

APPARATUS/PROCEDURE:

The previously degassed solvent flows in a thin film in an absorption spiral through the solvent vapor saturated gas at a total pressure of one atmosphere. Volume changes are measured in attached calibrated burets (1).

SOURCE AND PURITY OF MATERIALS:

1. Argon. British Oxygen Co. Ltd.
2. Water. No information given.
3. Electrolytes. No information given.

ESTIMATED ERROR:

$\delta k_s = \pm 0.010$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1952, 3819

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Alkali Metal Chlorides

ORIGINAL MEASUREMENTS:

Clever, H. L.; Holland, C. J.

J. Chem. Eng. Data 1968, 13, 411-414

VARIABLES: T/K: 303.15
Total P/kPa: 101.325 (1 atm)
Salt/mol kg^{-1} H_2O: 0 - 2.11

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Electrolyte mol kg^{-1} H_2O	No. of Det'n.	Bunsen Coefficient $\alpha \times 10^3$	Salt Effect Parameters	
				k_s= (1/C) log(α^o/α)	k_s= (1/m) log(α^o/α)
	Sodium Chloride; NaCl; 7647-14-5				
303.15	0.0	4	28.8 ± 0.3	-	-
	0.583	3	24.5 ∓ 0.5		0.138
	1.0337	3	21.2 ∓ 0.3		0.129
	2.1119	3	15.6 ∓ 0.0		0.126
				0.127 (authors)	0.132 (authors)
	Potassium Chloride; KCl; 7447-40-7				
303.15	0.0	4	28.8 ± 0.3	-	-
	0.3702	4	25.2 ∓ 0.4		0.157
	0.7627	4	22.3 ∓ 0.4		0.146
	1.0210	4	21.3 ∓ 0.2		0.129
	1.6778	4	18.2 ∓ 0.1		0.119
				0.125 (authors)	0.130 (authors)

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The apparatus was modeled after that of Markham and Kobe (1). A length of TRUEBORE tubing of 0.4643 cm^2 cross-section was used as the gas buret. The volume of argon, presaturated with the solvent vapor, taken up by a 103.1 cm^3 sample of the solvent was measured.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co. Inc. Stated to be 99.9 % argon.
2. Water. Distilled.
3. Alkali Metal Chlorides. Either Merck & Co. or J. T. Baker Co. Composition of the solutions determined by a Volhard titration.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 3$
$\delta\alpha/\alpha = 0.015 - 0.025$

REFERENCES:

1. Markham, A. E.; Kobe, K. A.
J. Am. Chem. Soc. 1941, 63, 449.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Sodium Chloride; NaCl; 7647-14-5

ORIGINAL MEASUREMENTS:

Eucken, A.; Hertzberg, G.

Z. physik. Chem. 1950, 195, 1 - 23.

VARIABLES:

T/K: 273.15 - 293.15

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Sodium Chloride mol kg^{-1} H_2O	Ostwald Coefficient L	Setschenow Constant $k = (1/m)\log(L^o/L)$
273.15	0.0	0.0526 (L^o)	-
	0.43	0.0443	0.172
	1.005	0.0343	0.183
	1.07	0.0337	0.178
	2.26	0.0208	0.178
	3.46	0.0147	0.180
293.15	0.0	0.0361 (L^o)	-
	0.54	0.0297	0.157
	1.13	0.0241	0.156
	1.91	0.0183	0.154

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Gas absorption. The apparatus consists of a gas buret and an absorption flask connected by a capillary tube. The whole apparatus is shaken. The capillary tube is a 2 m long glass helix. An amount of gas is measured at STP and placed in the gas buret. After shaking, the difference from the original amount of gas placed in the gas buret is determined.

SOURCE AND PURITY OF MATERIALS:

Components. No information given.

ESTIMATED ERROR:

$\delta L/L = 0.01$

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Sodium Chloride; NaCl; 7647-14-5

ORIGINAL MEASUREMENTS:

Mishnina, T. A.; Avdeeva, O. I.
Bozhovakaya, T. K.

Materialy Vses. Nauchn. Issled. Geol. Inst. 1961, 46, 93 - 110.

VARIABLES:

T/K: 278.15 - 348.15
P/kPa: 101.325 (1 atm)
NaCl/g eq dm^{-3}: 0 - 5.4

PREPARED BY:

A. L. Cramer
H. L. Clever

EXPERIMENTAL VALUES:

NaCl/g eq dm^{-3} T/K	Bunsen Coefficient, $\alpha \times 10^3$												Salt Effect Parameter k_s
	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.4	
278.15	48.8	40.2	33.1	27.2	22.4	18.4	15.2	12.5	10.3	8.5	7.0	6.0	0.169
283.15	41.6	34.8	29.8	24.4	20.8	17.0	14.6	11.9	10.2	8.4	7.0	6.0	0.155
288.15	36.7	31.1	26.3	22.2	18.8	15.9	13.8	11.4	9.6	8.2	6.9	6.0	0.145
293.15	33.4	28.5	24.4	20.8	17.8	15.2	13.0	11.1	9.4	8.1	6.9	6.1	0.137
298.15	30.6	26.2	22.5	19.3	16.6	14.2	12.2	10.5	9.0	7.7	6.6	5.8	0.133
303.15	28.2	24.3	20.9	18.0	15.5	13.3	11.5	9.9	8.5	7.3	6.3	5.6	0.130
308.15	26.4	22.8	19.7	17.0	14.6	12.6	10.9	9.4	8.1	7.0	6.0	5.4	0.128
313.15	25.0	21.6	18.7	16.2	14.0	12.1	10.5	9.0	7.8	6.8	5.9	5.2	0.126
318.15	23.7	20.5	17.8	15.4	13.4	11.6	10.1	8.7	7.6	6.6	5.7	5.1	0.124
323.15	22.5	19.5	17.0	14.7	12.8	11.1	9.6	8.4	7.2	6.3	5.5	4.9	0.123
328.15	21.6	18.8	16.4	14.3	12.4	10.8	9.4	8.2	7.1	6.2	5.4	4.9	0.120
333.15	20.9	18.2	15.9	13.8	12.1	10.5	9.2	8.0	7.0	6.1	5.3	4.8	0.119
338.15	20.2	17.6	15.4	13.4	11.7	10.3	8.9	7.8	6.8	6.0	5.2	4.7	0.118
343.15	19.5	17.0	14.9	13.0	11.5	9.9	8.7	7.6	6.6	5.8	5.1	4.6	0.117
348.15	19.0	16.6	14.6	12.7	11.4	9.7	8.5	7.5	6.5	5.7	5.0	4.5	0.116

The table of smoothed Bunsen coefficients of argon dissolved in aqueous sodium chloride solutions was prepared by the authors. The complete source of data for the table is not clear. The data of Morrison and Johnstone (J. Chem. Soc. 1954, 3441) are mentioned. A 1958 report of A. A. Cherepinnikov, mentioned in the paper, was not available to us.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Sodium Chloride; NaCl; 7647-14-5

ORIGINAL MEASUREMENTS:

Ben-Naim, A.; Egel-Thal, M.

J. Phys. Chem. 1965, 69, 3250-3253.

VARIABLES:

T/K: 278.15 - 298.15
Total P/kPa: 101.325 (1 atm)
Salt/mol kg^{-1} H_2O: 0 - 1

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Electrolyte mol kg^{-1} H_2O	Ostwald Coefficient $L \times 10^3$	Salt Effect Parameter $k_s = (1/m)\log(L^o/L)$
278.15	0.0	48.07	-
	1.0	33.15	0.161
283.15	0.0	43.36	-
	1.0	30.44	0.154
288.15	0.0	39.56	-
	1.0	28.16	0.148
293.15	0.0	36.63	-
	1.0	26.33	0.143
298.15	0.0	34.08	-
	1.0	24.77	0.139

The solubility values are the average of two to three measurements.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The apparatus of Ben-Naim and Baer (1) is used. There is a calibrated dissolution vessel which contains the degassed solvent. The gas is introduced wet from a gas buret. Stirring forces the liquid through the gas. The amount of gas dissolved is measured on a gas buret.

The entire apparatus is immersed in a water thermostat.

During outgassing a small change in salt concentration may occur. No correction for this is made.

SOURCE AND PURITY OF MATERIALS:

1. Argon. No source given.
2. Water. Distilled.
3. Sodium Chloride. Analar grade.

ESTIMATED ERROR:

$\delta m/m = 0.01$

Overall apparatus precision ± 0.2% (authors)

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Sodium Chloride; NaCl; 7647-14-5

ORIGINAL MEASUREMENTS:

Abrosimov, V. K.; Badelin, V. G.;
Krestov, G. A.

Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol. 1976, 19, 1381 - 1386.

VARIABLES:

T/K: 283.15 - 313.15
P/kPa: 101.325 (1 atm)
NaCl/mol kg^{-1} H_2O: 0 - 2.9485

PREPARED BY:

A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Sodium Chloride mol kg^{-1} H_2O	Argon Solubility A_{sm}	Salt Effect Parameter $k = (1/m) \log (A^o/A)$
283.15	0.0	41.81	-
	0.2347	38.46	0.1545
	0.4414	35.72	0.1549
	0.9652	30.22	0.1461
	1.5892	25.11	0.1393
	2.1864	20.94	0.1374
293.15	0.0	34.21	-
	0.0439	33.50	0.2075
	0.2119	31.89	0.1439
	0.4081	30.29	0.1295
	1.2487	24.20	0.1204
	1.6829	21.15	0.1241
	2.9485	15.17	0.1198
303.15	0.0	29.00	-
	0.1071	28.00	0.1423
	0.2350	27.07	0.1273
	0.4228	25.54	0.1305
	0.9094	22.33	0.1248
	2.4000	15.08	0.1183
313.15	0.0	25.40	-
	0.1553	24.50	0.1009
	0.2368	24.01	0.1032
	0.5441	22.02	0.1140
	1.1234	19.11	0.1100
	1.7888	16.16	0.1098

COMMENTS: The authors define the solubility of argon, A_{sm}, as

$$A_{sm} = \frac{v^o(M_{r,1}55.51 + C_{sm}M_{r,2})}{v_{p-p}\ 1000\ \rho_{p-p}}$$

where v^o ml Ar at 101.325 kPa and standard conditions,
v_{p-p} = ml solution, ρ_{p-p} = solution density, $M_{r,1}$ and $M_{r,2}$ = water and salt molecular weight, C_{sm} = mol salt kg^{-1} water.

SOURCE AND PURITY OF MATERIALS:

APPARATUS/PROCEDURE:

The apparatus and procedure were presumably based on those described by Ben-Naim and Baer (1).

See page 58 for additional comments.

ESTIMATED ERROR:

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Sodium Bromide; NaBr; 7647-15-6

ORIGINAL MEASUREMENTS:

Clever, H. L.; Holland, C. J.

J. Chem. Eng. Data 1968, 13, 411-414.

VARIABLES: T/K: 303.14
Total P/kPa: 101.325 (1 atm)
NaBr/mol kg^{-1} H_2O: 0 - 2.044

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Electrolyte mol kg^{-1} H_2O	No. of Det'n.	Bunsen Coefficient $\alpha \times 10^3$	Salt Effect Parameters	
				$k_s = (1/C)\log(\alpha^o/\alpha)$	$k_s = (1/m)\log(\alpha^o/\alpha)$
303.15	0.0	4	28.8 ± 0.3	-	-
	0.4910	5	24.3 ± 0.4		0.150
	0.9867	4	21.3 ± 0.2		0.133
	2.0440	5	16.1 ± 0.2		0.124
				0.126 (authors)	0.132 (authors)

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The apparatus was modeled after that of Markham and Kobe (1). A length of TRUEBORE tubing of 0.4643 cm^2 cross-section was used as the gas buret. The volume of argon, presaturated with the solvent vapor, taken up by a 103.1 cm^3 sample of the solvent was measured.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co. Inc. Stated to be 99.9 % argon.
2. Water. Distilled.
3. Sodium Bromide. Either Merck & Co. or J. T. Baker Co. Composition of the solutions determined by a Volhard titration.

ESTIMATED ERROR:
$\delta T/K = 0.03$
$\delta P/mmHg = 3$
$\delta\alpha/\alpha = 0.015 - 0.025$

REFERENCES:

1. Markham, A. E.; Kobe, K. A. J. Am. Chem. Soc. 1941, 63, 449.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Sodium Iodide; NaI; 7681-82-5

ORIGINAL MEASUREMENTS:

Clever, H. L.; Reddy, G. S.

J. Chem. Eng. Data 1963, 8, 191 - 192.

VARIABLES:

T/K: 303.15
Total P/kPa: 101.325 (1 atm)
Salt/mol dm^{-3}: 0 - 6.99

PREPARED BY:

S. A. Johnson

EXPERIMENTAL VALUES:

T/K	Sodium Iodide mol dm^{-3}	Ostwald Solubility Ratio L^o/L	Salt Effect Parameter $k_s = (1/C)\log(L^o/L)$
303.15	0.0	1.0	-
	0.782	1.350	0.167
	1.33	1.575	0.148
	2.23	1.950	0.130
	3.56	2.605	0.117
	5.25	3.615	0.106
	6.99	4.370	0.092

The Bunsen coefficient of argon in water was found to be 0.0231.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The apparatus was modeled after that of Markham and Kobe (1). A length of TRUEBORE tubing of 0.4643 cm^2 cross-section was used as the gas buret. The volume of argon, presaturated with the solvent vapor, taken up by a 103.1 cm^3 sample of the solvent was measured.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Inc. Regular grade, 99.998 % pure.
2. Water. Distilled.
3. Sodium Iodide. J. T. Baker Analyzed Reagent Grade. Used as received.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 3$
$\delta\alpha/\alpha = 0.015 - 0.025$

REFERENCES:

1. Markham, A. E.; Kobe, K. A. J. Am. Chem. Soc. 1941, 63, 449.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Sodium Iodide; NaI; 7681-82-5

ORIGINAL MEASUREMENTS:

Ben-Naim, A.; Egel-Thal, M.

J. Phys. Chem. 1965, *69*, 3250-3253.

VARIABLES:

T/K: 278.15 - 298.15
Total P/kPa: 101.325 (1 atm)
Salt/mol kg^{-1} H_2O: 0 - 1

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Electrolyte mol kg^{-1} H_2O	Ostwald Coefficient $L \times 10^3$	Salt Effect Parameter $k_s = (1/m)\log(L^o/L)$
278.15	0.0	48.07	-
	1.0	33.25	0.160
283.15	0.0	43.36	-
	1.0	30.86	0.148
288.15	0.0	39.56	-
	1.0	28.57	0.141
293.15	0.0	36.63	-
	1.0	26.90	0.134
298.15	0.0	34.08	-
	1.0	25.50	0.126

The solubility values are the average of two to three measurements.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The apparatus of Ben-Naim and Baer (1) is used. There is a calibrated dissolution vessel which contains the degassed solvent. The gas is introduced wet from a gas buret. Stirring forces the liquid through the gas. The amount of gas dissolved is measured on a gas buret.

The entire apparatus is immersed in a water thermostat.

During outgassing a small change in salt concentration may occur. No correction for this is made.

SOURCE AND PURITY OF MATERIALS:

1. Argon. No source given.
2. Water. Distilled.
3. Sodium Iodide. Analar grade.

ESTIMATED ERROR:

$\delta m/m = 0.01$

Overall apparatus precision ± 0.2% (authors)

REFERENCES:

1. Ben-Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Sodium Iodide; NaI; 7681-82-5

ORIGINAL MEASUREMENTS:

Clever, H. L.; Holland, C. J.

J. Chem. Eng. Data 1968, 13, 411-414.

VARIABLES:

T/K: 296.15 - 313.15
Total P/kPa: 101.325 (1 atm)
NaI/mol kg^{-1} H_2O: 0 - 3.8766

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Electrolyte mol kg^{-1} H_2O	No. of Det'n.	Bunsen Coefficient $\alpha \times 10^3$	Salt Effect Parameters	
				$k_s = (1/C)\log(\alpha^o/\alpha)$	$k_s = (1/m)\log(\alpha^o/\alpha)$
296.15	0.0	-	32.3	-	-
	0.6712	7	26.1 ± 0.4		0.138
	1.0773	3	22.4 ± 0.4		0.148
	2.2264	3	15.5 ± 0.1		0.143
				0.143 (authors)	0.155 (authors)
303.15	0.0	4	28.8 ± 0.3	-	-
	0.5016	4	24.1 ± 0.5		0.154
	1.0840	3	20.9 ± 0.2		0.128
	2.0180	5	15.2 ± 0.3		0.138
	3.8766	5	8.3 ± 0.3		0.139
				0.138 (authors)	0.155 (authors)
313.15	0.0	4	25.2 ± 0.3	-	-
	0.6712	4	20.4 ± 0.4		0.137
	1.0773	3	17.7 ± 0.1		0.142
	2.2264	3	12.6 ± 0.1		0.135
				0.136 (authors)	0.147 (authors)

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The apparatus was modeled after that of Markham and Kobe (1). A length of TRUEBORE tubing of 0.4643 cm^2 cross-section was used as the gas buret. The volume of argon, presaturated with the solvent vapor, taken up by a 103.1 cm^3 sample of the solvent was measured.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co. Inc. Stated to be 99.9 % argon.
2. Water. Distilled.
3. Sodium Iodide. Either Merck & Co. or J. T. Baker Co. Composition of the solutions determined by a Volhard titration.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 3$
$\delta\alpha/\alpha = 0.015 - 0.025$

REFERENCES:

1. Markham, A. E.; Kobe, K. A. *J. Am. Chem. Soc.* 1941, 63, 449.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Sodium Iodide; NaI; 7681-82-5

ORIGINAL MEASUREMENTS:

Abrosimov, V. K.; Badelin, V. G.; Krestov, G. A.

Izv. Vyssh. Uchebn. Zaved.,Khim. Khim. Tekhnol. 1976, 19, 1381 - 1386.

VARIABLES:

T/K: 283.15 - 313.15
P/kPa: 101.325 (1 atm)
NaI/mol kg^{-1} H_2O: 0 - 2.3242

PREPARED BY:

A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Sodium Iodide mol kg^{-1} H_2O	Argon Solubility A_{sm}	Salt Effect Parameter $k = (1/C_{sm}) \log (A°/A)$
283.15	0.0	41.81	-
	0.1508	39.63	0.1542
	0.3171	37.51	0.1486
	0.5890	34.54	0.1408
	0.8504	31.86	0.1388
	2.3242	20.47	0.1334
293.15	0.0	34.21	-
	0.0962	33.61	0.1839
	0.2397	32.15	0.1283
	0.5680	29.18	0.1216
	0.9824	26.31	0.1161
	1.2376	24.36	0.1192
	1.9359	20.41	0.1159
303.15	0.0	29.00	-
	0.1085	28.20	0.1120
	0.1972	27.39	0.1258
	0.5030	25.32	0.1172
	0.8579	23.28	0.1112
	2.0872	17.69	0.1029
313.15	0.0	25.40	-
	0.1285	24.94	0.0618
	0.2969	24.01	0.0823
	0.5567	22.78	0.0849
	1.2626	19.57	0.0897
	1.7716	17.41	0.0922

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure were presumably based on those described by Ben-Naim and Baer (1, 2).

The authors define the solubility of argon, A_{sm}, as

$$A_{sm} = \frac{v° \; (55.51 \; M_{r,1} + C_{sm} M_{r,2})}{v_{p-p} \; 1000 \; \rho_{p-p}}$$

where v° = ml Ar at 101.325 kPa and standard conditions, v_{p-p} = ml solution, ρ_{p-p} = solution density, g ml^{-1}, $M_{r,1}$ and $M_{r,2}$ = water and salt mol weight, respectively, and C_{sm} = salt mol kg^{-1} water (55.51 mol water). The authors also define A_{sm} as ml Ar at 101.325 kPa and standard conditions $(55.51 \text{ mol } H_2O)^{-1}$, but if that is the definition it appears the 1000 should be deleted from the equation denominator.

SOURCE AND PURITY OF MATERIALS:

No information given.

ESTIMATED ERROR:

$\delta A/A = 0.01$ (Compiler)

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.

2. Patsatsiya, K. M.; Krestov, G. A. Zh. Fiz. Khim. 1970, 44, 1835.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Sodium Nitrate; $NaNO_3$; 7631-99-4

ORIGINAL MEASUREMENTS:

Akerlof, G.

J. Am. Chem. Soc. 1935, 57, 1196-1201.

VARIABLES:

T/K: 298.15
P/kPa: 101.325 (1 atm)
Salt/mol kg^{-1} H_2O: 0 - 7.37

PREPARED BY:

T. D. Kittredge
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Electrolyte Mol kg^{-1} H_2O	Argon Solubility dm^3 Ar (STP) kg^{-1} H_2O	Salt Effect Parameters $k_S = (1/m)\log(S^o/S)$	$k_{SX} = (1/m)\log(X^o/X)$
298.15	0.00	0.0332	-	-
	3.51	0.0204	0.060	0.075
	7.37	0.0123	0.059	0.073

The compiler calculated the salt effect parameters on a molality basis.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas absorption method. The solution was prepared and its concentration calculated from the measured density (Mohr-Westphal balance) and density tables in the International Critical Tables (Vol. III). The solution was degassed by heating, then boiling in a vacuum for 45 minutes.

The argon was presaturated with water vapor from the solution. The solution volume was measured by displacement of an equivalent volume of mercury as the gas and solution were brought into contact. The gas-liquid interface, of relatively large area, was gently stirred for two hours, although equilibrium appeared to be established within a matter of minutes. The decrease in gas volume due to solution was measured on the attached buret system.

The solubility values were reported as dm^3 Ar (STP) kg^{-1} water. This is equivalent to the Kuenen coefficient when water alone is the solvent.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Source not given. Stated to be 99 per cent argon with most of the impurity nitrogen.
2. Water. No information.
3. Electrolyte. Source not given. Stated to be of the "analyzed variety".

ESTIMATED ERROR:

$\delta T/K = 0.01$
$\delta S/S = 0.01$ (author)

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Potassium Hydroxide; KOH; 1310-58-3

ORIGINAL MEASUREMENTS:

Shoor, S. K.; Walker, R. D. Jr.; Gubbins, K. E.

J. Phys. Chem. 1969, 73, 312 - 317.

VARIABLES:

T/K: 298.15 - 353.15
P/kPa: 101.325 (1 atm)
KOH/wt %: 0 - 41.40

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Potassium Hydroxide Wt %	Potassium Hydroxide mol dm^{-3}	Mol Fraction $Ar/X_1 \times 10^3$	Solubility Ratio $\gamma = X^o/X$	Salt Effect Parameter $k_s = (1/C) \log (X^o/X)$
298.15	0.0	0.0	0.0253	1.00	-
	5.00	0.92		1.56	0.210
	13.50	2.67		3.18	0.188
	23.00	5.00		7.68	0.177
	32.40	7.60		22.8	0.179
	41.40	10.37		70.3	0.178
					0.179 (authors)
313.15	0.0	0.0	0.0200	1.00	-
	5.00	0.92		1.48	0.185
	13.50	2.67		2.81	0.168
	23.00	5.00		6.93	0.170
	41.40	10.37		58.2	0.168
					0.168 (authors)
333.15	0.0	0.0	0.0168	1.00	-
	5.00	0.92		1.40	0.159
	13.50	2.67		2.59	0.155
	23.00	5.00		5.85	0.153
	31.61	7.35		14.5	0.158
	41.40	10.37		46.1	0.160
					0.158 (authors)
353.15	0.0	0.0	0.0152	1.00	-
	5.00	0.92		1.32	0.131
	13.50	2.67		2.48	0.148
	23.00	5.00		5.57	0.149
	31.61	7.35		13.4	0.153
	40.70	10.15		30.0	0.146
					0.148 (authors)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A gas chromatographic method was used (1). All analyses were made with a thermal conductivity detector and with helium as the carrier gas. The argon saturated solutions were prepared by bubbling the gas through presaturators and then through the KOH solution. Samples were drawn from the solution over a 48 hour period to determine whether or not equilibrium was established. Samples were transferred from the saturator to the gas chromatograph in gas tight Hamilton syringes.

The results are reported as activity coefficients, which are the mole fraction solubility ratio, X^o/X, where X^o is the argon mole fraction solubility in water and X is the argon mole fraction solubility in the aqueous KOH solution, both at a gas partial pressure of 1 atm. Solubility values were corrected to 1 atm assuming Henry's law is obeyed. The activity coefficients are the average of at least four measurements.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Source not given. Minimum purity 99.99 %.
2. Water. Distilled and degassed in glass-teflon still.
3. Potassium Hydroxide. Baker Analyzed Reagent Grade. Contained a maximum of 1 % K_2CO_3. The KOH solutions were protected from atm CO_2.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta \gamma/\gamma = 0.01$

REFERENCES:

1. Gubbins, K. E.; Carden, S. N.; Walker, R. D. Jr. J. Gas Chromatog. 1965, 3, 98.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Potassium Chloride; KCl; 7447-40-7

ORIGINAL MEASUREMENTS:

Ben-Naim, A.; Egel-Thal, M.

J. Phys. Chem. 1965, 69, 3250-3253.

VARIABLES:

T/K: 278.15 - 298.15
Total P/kPa: 101.325 (1 atm)
Salt/mol kg^{-1} H_2O: 0 - 1

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Electrolyte mol kg^{-1} H_2O	Ostwald Coefficient $L \times 10^3$	Salt Effect Parameter $k_s = (1/m)\log(L^o/L)$
278.15	0.0	48.07	-
	1.0	33.79	0.153
283.15	0.0	43.36	-
	1.0	31.10	0.144
288.15	0.0	39.56	-
	1.0	28.85	0.137
293.15	0.0	36.63	-
	1.0	27.05	0.132
298.15	0.0	34.08	-
	1.0	25.51	0.126

The solubility values are the average of two to three measurements.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus of Ben-Naim and Baer (1) is used. There is a calibrated dissolution vessel which contains the degassed solvent. The gas is introduced wet from a gas buret. Stirring forces the liquid through the gas. The amount of gas dissolved is measured on a gas buret.

The entire apparatus is immersed in a water thermostat.

During outgassing a small change in salt concentration may occur. No correction for this is made.

SOURCE AND PURITY OF MATERIALS:

1. Argon. No source given.
2. Water. Distilled.
3. Potassium Chloride. Analar grade.

ESTIMATED ERROR:

$\delta m/m = 0.01$

Overall apparatus precision ± 0.2% (authors)

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Potassium Bromide; KBr; 7758-02-3

ORIGINAL MEASUREMENTS:

Ben-Naim, A.; Egel-Thal, M.

J. Phys. Chem. 1965, 69, 3250-3253.

VARIABLES:

T/K: 278.15 - 298.15
Total P/kPa: 101.325 (1 atm)
Salt/mol kg^{-1} H_2O: 0 - 1

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Electrolyte mol kg^{-1} H_2O	Ostwald Coefficient $L \times 10^3$	Salt Effect Parameter $k_s = (1/m)\log(L^o/L)$
278.15	0.0	48.07	-
	1.0	34.07	0.150
283.15	0.0	43.36	-
	1.0	31.24	0.142
288.15	0.0	39.56	-
	1.0	28.94	0.136
293.15	0.0	36.63	-
	1.0	27.11	0.131
298.15	0.0	34.08	-
	1.0	25.57	0.125

The solubility values are the average of two to three measurements.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The apparatus of Ben-Naim and Baer (1) is used. There is a calibrated dissolution vessel which contains the degassed solvent. The gas is introduced wet from a gas buret. Stirring forces the liquid through the gas. The amount of gas dissolved is measured on a gas buret.

The entire apparatus is immersed in a water thermostat.

During outgassing a small change in salt concentration may occur. No correction for this is made.

SOURCE AND PURITY OF MATERIALS:

1. Argon. No source given.
2. Water. Distilled.
3. Potassium Bromide. Analar grade.

ESTIMATED ERROR:

$\delta m/m = 0.01$

Overall apparatus precision ± 0.2% (authors)

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Potassium Bromide; KBr; 59141-09-2

ORIGINAL MEASUREMENTS:

Abrosimov, V. K.; Badelin, V. G.; Krestov, G. A.

Izv. Vyssh. Ucheb. Zaved.,Khim. Khim. Tekhnol. 1976, 19, 1381 - 1386.

VARIABLES:

T/K: 283.15 - 313.15
P/kPa: 101.325 (1 atm)
KBr/mol kg^{-1} H_2O: 0 - 2.1465

PREPARED BY:

A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Potassium Bromide mol kg^{-1} H_2O	Argon Solubility A_{sm}	Salt Effect Parameter $k = (1/C_{sm}) \log (A°/A)$
283.15	0.0	41.81	-
	0.1434	40.00	0.1340
	0.2030	39.09	0.1439
	0.5404	35.49	0.1317
	1.2605	29.26	0.1230
	2.1465	24.08	0.1116
293.15	0.0	34.21	-
	0.0917	33.45	0.1348
	0.2095	32.52	0.1050
	0.4939	30.11	0.1123
	0.9766	26.72	0.1099
	1.8581	21.95	0.1037
303.15	0.0	29.00	-
	0.1013	28.08	0.1382
	0.1880	27.57	0.1168
	0.5859	25.01	0.1097
	1.1486	22.17	0.1015
	1.9871	18.58	0.0973
313.15	0.0	25.40	-
	0.1277	25.01	0.0526
	0.5811	22.46	0.0919
	0.6173	22.42	0.0878
	1.1488	20.22	0.0862
	1.9362	17.21	0.0873

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure were presumably based on those described by Ben-Naim and Baer (1, 2).

The authors define the solubility of argon, A_{sm}, as

$$A_{sm} = \frac{v° \ (55.51 M_{r,1} + C_{sm} M_{r,2})}{v_{p-p} \ 1000 \ \rho_{p-p}}$$

where v° = ml Ar at 101.325 kPa and standard conditions, v_{p-p} = ml solution, ρ_{p-p} = solution density, g ml^{-1}, $M_{r,1}$ and $M_{r,2}$ = water and salt mol weight, respectively, and C_{sm} = salt mol kg^{-1} water (55.51 mol water). The authors also define A_{sm} as ml Ar at 101.325 kPa and standard conditions $(55.51 \text{ mol } H_2O)^{-1}$, but if that is the definition it appears the 1000 should be deleted from the equation denominator.

SOURCE AND PURITY OF MATERIALS:

No information given.

ESTIMATED ERROR:

$\delta A/A = 0.01$ (Compiler)

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.
2. Patsatsiya, K. M.; Krestov, G. A. Zh. Fiz. Khim. 1970, 44, 1835.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Potassium Iodide; KI; 7681-11-0

ORIGINAL MEASUREMENTS:

Ben-Naim, A.; Egel-Thal, M.

J. Phys. Chem. 1965, 69, 3250-3253.

VARIABLES:

T/K: 278.15 - 298.15
Total P/kPa: 101.325 (1 atm)
Salt/mol kg^{-1} H_2O; 0 - 4

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Electrolyte mol kg^{-1} H_2O	Ostwald Coefficient $L \times 10^3$	Salt Effect Parameter $k_s = (1/m)\log(L^o/L)$
278.15	0	48.07	-
	1	33.41	0.158
	2	24.53	0.146
	4	14.17	0.133
283.15	0	43.36	-
	1	30.83	0.148
	2	22.91	0.138
	4	13.48	0.127
288.15	0	39.56	-
	1	28.68	0.140
	2	21.58	0.132
	4	12.96	0.121
293.15	0	36.63	-
	1	26.98	0.133
	2	20.54	0.126
	4	12.59	0.116
298.15	0	34.08	-
	1	25.57	0.125
	2	19.68	0.119
	4	12.32	0.110

The solubility values are the average of two to three measurements.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus of Ben-Naim and Baer (1) is used. There is a calibrated dissolution vessel which contains the degassed solvent. The gas is introduced wet from a gas buret. Stirring forces the liquid through the gas. The amount of gas dissolved is measured on a gas buret.

The entire apparatus is immersed in a water thermostat.

During outgassing a small change in salt concentration may occur. No correction for this is made.

SOURCE AND PURITY OF MATERIALS:

1. Argon. No source given.
2. Water. Distilled.
3. Potassium Iodide. Analar grade.

ESTIMATED ERROR:

$\delta m/m = 0.01$

Overall apparatus precision ± 0.2% (authors)

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Potassium Iodide; KI; 7681-11-0

ORIGINAL MEASUREMENTS:

Abrosimov, V. K.; Badelin, V. G.; Krestov, G. A.

Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1976, 19, 1381 - 1386.

VARIABLES:

T/K: 283.15 - 313.15
P/kPa: 101.325 (1 atm)
KI/mol kg^{-1} H_2O: 0 - 2.1345

PREPARED BY:

A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Potassium Iodide mol kg^{-1} H_2O	Argon Solubility A_{sm}	Salt Effect Parameter $k = (1/C_{sm}) \log (A°/A)$
283.15	0.0	41.81	-
	0.1514	39.80	0.1413
	0.3029	38.21	0.1291
	0.5947	35.69	0.1156
	1.2591	29.21	0.1237
	2.1345	23.56	0.1167
293.15	0.0	34.21	-
	0.0750	33.48	0.1249
	0.0895	33.47	0.1061
	0.2907	31.92	0.1035
	0.6015	29.43	0.1087
	1.0722	26.20	0.1081
	1.5708	22.67	0.1138
303.15	0.0	29.00	-
	0.1040	28.35	0.0947
	0.1815	27.93	0.0900
	0.4245	26.28	0.0814
	0.8670	24.29	0.0888
	1.7167	19.94	0.0948
313.15	0.0	25.40	-
	0.1001	25.07	0.0567
	0.1704	24.65	0.0764
	0.1804	23.36	0.0757
	1.0151	21.42	0.0767
	1.6690	18.82	0.0780

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The apparatus and procedure were presumably based on those described by Ben-Naim and Baer (1, 2).

The authors define the solubility of argon, A_{sm}, as

$$A_{sm} = \frac{v° \ (55.51 \ M_{r,1} + C_{sm} M_{r,2})}{v_{p-p} \ 1000 \ \rho_{p-p}}$$

where v° = ml Ar at 101.325 kPa and standard conditions, v_{p-p} = ml solution, ρ_{p-p} = solution density, g ml^{-1}, $M_{r,1}$ and $M_{r,2}$ = water and salt mol weight, respectively, and C_{sm} = salt mol kg^{-1} water (55.51 mol water). The authors also define A_{sm} as ml Ar at 101.325 kPa and standard conditions $(55.51 \text{ mol } H_2O)^{-1}$, but if that is the definition it appears the 1000 should be deleted from the equation denominator.

SOURCE AND PURITY OF MATERIALS:

No information given.

ESTIMATED ERROR:

$\delta A/A = 0.01$ (Compiler)

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday. Soc. 1963, 59, 2735.
2. Patsatsiya, K. M.; Krestov, G. A. Zh. Fiz. Khim. 1970, 44, 1835.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Cesium Chloride; CsCl; 7647-17-8

ORIGINAL MEASUREMENTS:

Abrosimov, V. K.; Badelin, V. G.
Krestov, G. A.

Izv. Vyssh. Ucheb. Zaved.,Khim. Khim. Tekhnol. 1976, 19, 1381 - 1386.

VARIABLES:

T/K: 283.15 - 313.15
P/kPa: 101.325 (1 atm)
CsCl/mol kg^{-1} H_2O: 0 - 2.4019

PREPARED BY:

A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Cesium Chloride mol kg^{-1} H_2O	Argon Solubility A_{sm}	Salt Effect Parameter $k = (1/C_{sm}) \log (A°/A)$
283.15	0.0	41.81	-
	0.2218	39.26	0.1232
	0.5196	36.32	0.1177
	0.9251	32.85	0.1100
	1.6998	27.67	0.1036
293.15	0.0	34.21	-
	0.1630	32.92	0.1024
	0.2958	31.85	0.1049
	0.6479	29.41	0.1013
	1.4554	24.74	0.0967
	1.9811	22.09	0.0959
303.15	0.0	29.00	-
	0.1097	28.28	0.0995
	0.2590	27.39	0.0958
	0.7364	24.79	0.0925
	1.1351	22.98	0.0890
	1.4965	21.65	0.0848
	2.4019	18.39	0.0823
313.15	0.0	25.40	-
	0.1339	25.04	0.0463
	0.2651	24.36	0.0685
	0.6913	22.39	0.0792
	1.1225	20.82	0.0769
	1.6613	18.99	0.0760

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The apparatus and procedure were presumably based on those described by Ben-Naim and Baer (1, 2).

The authors define the solubility of argon, A_{sm}, as

$$A_{sm} = \frac{v°(55.51M_{r,1} + C_{sm}M_{r,2})}{v_{p-p}\ 1000\ \rho_{p-p}}$$

where v° = ml Ar at 101.325 kPa and standard conditions, v_{p-p} = ml solution, ρ_{p-p} = solution density, g ml^{-1}, $M_{r,1}$ and $M_{r,2}$ = water and salt mol weight, respectively, and C_{sm} = salt mol kg^{-1} water (55.51 mol water). The authors also define A_{sm} as ml Ar at 101.325 kPa and standard conditions (55.51 mol $H_2O)^{-1}$, but if that is the definition it appears the 1000 should be deleted from the equation denominator.

SOURCE AND PURITY OF MATERIALS:

No information given.

ESTIMATED ERROR:

$\delta A/A = 0.01$ (Compiler)

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735

2. Patsatsiya, K. M.; Krestov, G. A. Zh. Fiz. Khim. 1970, 44, 1835.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Cesium Bromide; CsBr; 59141-08-1

ORIGINAL MEASUREMENTS:

Abrosimov, V. K.; Badelin, V. G.; Krestov, G. A.

Izv. Vyssh. Ucheb. Zaved.,Khim. Khim. Tekhnol. 1976, 19, 1381 - 1386.

VARIABLES:

T/K: 283.15 - 313.15
P/kPa: 101.325 (1 atm)
CsBr/mol kg^{-1} H_2O: 0 - 2.4317

PREPARED BY:

A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Cesium Bromide mol kg^{-1} H_2O	Argon Solubility A_{sm}	Salt Effect Parameter $k = (1/C_{sm}) \log (A°/A)$
283.15	0.0	41.81	-
	0.1335	40.29	0.1205
	0.2935	38.69	0.1148
	0.5998	36.05	0.107
	1.2974	30.64	0.104
	2.1614	25.83	0.0968
293.15	0.0	34.21	-
	0.1179	33.55	0.0718
	0.2392	32.59	0.0881
	0.6077	30.12	0.0910
	1.2330	26.70	0.0873
	1.6996	24.52	0.0851
303.15	0.0	29.00	-
	0.1157	28.14	0.113
	0.2039	27.62	0.104
	0.4934	26.28	0.0867
	1.0065	23.76	0.0860
	1.8344	20.62	0.0807
313.15	0.0	25.40	-
	0.1168	25.39	0.0015
	0.2537	24.55	0.0583
	0.5392	23.35	0.0678
	1.0993	21.29	0.0697
	2.4317	17.19	0.0697

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The apparatus and procedure were presumably based on those described by Ben-Naim and Baer (1, 2).

The authors define the solubility of argon, A_{sm}, as

$$\frac{v° \ (55.51M_{r,1} + C_{sm}M_{r,2})}{v_{p-p} \ 1000 \ \rho_{p-p}}$$

where $v°$ = ml Ar at 101.325 kPa and standard conditions, v_{p-p} = ml solution, ρ_{p-p} = solution density, g ml^{-1}, $M_{r,1}$ and $M_{r,2}$ = water and salt mol weight, respectively, and C_{sm} = salt mol kg^{-1} water (55.51 mol water). The authors also define A_{sm} as ml Ar at 101.325 kPa and standard conditions (55.51 mol $H_2O)^{-1}$, but if that is the definition it appears the 1000 should be deleted from the equation denominator.

SOURCE AND PURITY OF MATERIALS:

No information given

ESTIMATED ERROR:

$\delta A/A = 0.01$ (Compiler)

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.

2. Patsatsiya, K. M.; Krestov, G. A. Zh. Fiz. Khim. 1970, 44, 1835.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Rubidium Chloride; RbCl; 7791-11-9

ORIGINAL MEASUREMENTS:

Abrosimov, V. K.; Badelin, V. G.; Krestov, G. A.

Izv. Vyssh. Ucheb. Zaved.,Khim. Khim. Tekhnol. 1976, 19, 1381 - 1386.

VARIABLES:

T/K: 283.15 313.15
P/kPa: 101.325 (1 atm)
RbCl/mol kg^{-1} H_2O: 0 - 2.3879

PREPARED BY:

A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Rubidium Chloride mol kg^{-1} H_2O	Argon Solubility A_{sm}	Salt Effect Parameter $k = (1/C_{sm}) \log (A°/A)$
283.15	0.0	41.81	-
	0.1300	40.01	0.1470
	0.4524	36.55	0.1291
	0.9800	31.72	0.1224
	2.2877	23.11	0.1125
293.15	0.0	34.21	-
	0.1637	33.06	0.0907
	0.3285	31.52	0.1083
	0.8376	27.83	0.1070
	1.4975	23.86	0.1045
	2.3706	19.96	0.0987
303.15	0.0	29.00	-
	0.0916	28.20	0.1326
	0.2189	27.26	0.1228
	0.4461	25.80	0.1138
	1.1180	22.11	0.1054
	1.6738	19.87	0.0981
313.15	0.0	25.40	-
	0.1523	24.60	0.0913
	0.2862	23.89	0.0930
	0.6897	22.05	0.0891
	1.1713	19.90	0.0905
	2.3879	15.75	0.0869

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The apparatus and procedure were presumably based on those described by Ben-Naim and Baer (1, 2).

The authors define the solubility of argon, A_{sm}, as

$$A_{sm} = \frac{v° \ (55.51 M_{r,1} + C_{sm} M_{r,2})}{v_{p-p} \ 1000 \ \rho_{p-p}}$$

where v° = ml Ar at 101.325 kPa and standard conditions, v_{p-p} = ml solution, ρ_{p-p} = solution density, g ml^{-1}, $M_{r,1}$ and $M_{r,2}$ = water and salt mol weight, respectively, and C_{sm} = salt mol kg^{-1} water (55.51 mol water). The authors also define A_{sm} as ml Ar at 101.325 kPa and standard conditions $(55.51 \text{ mol } H_2O)^{-1}$, but if that is the definition it appears the 1000 should be deleted from the equation denominator.

SOURCE AND PURITY OF MATERIALS:

No information given.

ESTIMATED ERROR:

$\delta A/A = 0.01$ (Compiler)

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.
2. Patsatsiya, K. M.; Krestov, G. A. Zh. Fiz. Khim. 1970, 44, 1835.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water-d_2; D_2O; 7789-20-0
3. Lithium Chloride; LiCl; 7447-41-8

ORIGINAL MEASUREMENTS:

Abrosimov, V. K.; Badelin, V. G.; Krestov, G. A.

Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1977, 20, 1864 - 1866.

VARIABLES:

T/K: 283.15 - 313.15
P/kPa: 101.325 (1 atm)
LiCl/mol (55.51 mol D_2O)$^{-1}$: 0-2.6843

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Lithium Chloride/mol (55.51 mol D_2O)$^{-1}$	Argon Solubility A_{sm}	Salt Effect Parameter $K = (1/C_{sm}) \log (A°/A)$
283.15	0.0	46.40	-
	0.2455	43.69	0.1065
	0.6287	39.82	0.1056
	1.0229	36.19	0.1055
	2.1481	28.14	0.1011
293.15	0.0	36.90	-
	0.2544	34.92	0.0942
	0.5339	32.69	0.0950
	1.0924	29.00	0.0958
	2.0923	23.66	0.0922
303.15	0.0	30.74	-
	0.2562	29.06	0.0953
	0.7381	26.21	0.0938
	1.3381	23.17	0.0918
	2.6843	18.13	0.0854
313.15	0.0	26.68	-
	0.2926	25.24	0.0824
	0.6384	23.66	0.0817
	1.8226	19.06	0.0801
	2.4194	17.10	0.0799

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The precision microgasometric apparatus described earlier (1) is used.

The argon solubility is reported as the "solvomolal absorption coefficient, A_{sm}." It is defined as the volume of pure gas at a partial pressure of 101.325 kPa and normal conditions, absorbed by the quantity of solvent which contains 55.51 moles of D_2O.

It is calculated from the formula

$$A_{sm} = \frac{\alpha(55.51\, M_{r,2} + C_{sm,p-p}M_{r,3})}{\rho_{p-p}}$$

where α is the Bunsen coefficient,
ρ_{p-p} is the solution density, g ml^{-1},
$M_{r,2}$ and $M_{r,3}$ are the D_2O and salt molecular weights, respectively, and
$C_{sm,p-p}$ is mol salt (55.51 mol D_2O)$^{-1}$.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially purified sample, designated MRTU-6-02-376-66, with total impurities not exceeding 0.015%.
2. Water-d_2. 99.8 atom % D.
3. Salt. Chemically pure.

ESTIMATED ERROR:

$\delta A/A = 0.002$ (authors)

REFERENCES:

1. Strakov, A. N.; Krestov, G. A.; Abrosimov, V. K.; Badelin, V. G. Zh. Fiz. Khim. 1975, 49, 1583.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water-d_2; D_2O; 7789-20-0
3. Sodium Chloride; NaCl; 7647-14-5

ORIGINAL MEASUREMENTS:

Abrosimov, V. K.; Badelin, V. G.; Krestov, G. A.

Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1977, *20*, 1864 - 1866.

VARIABLES:

T/K: 283.15 - 313.15
P/kPa: 101.325 (1 atm)
NaCl/mol (55.51 mol $D_2O)^{-1}$: 0-2.3362

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Sodium Chloride/mol (55.51 mol $D_2O)^{-1}$	Argon Solubility A_{sm}	Salt Effect Parameter $k = (1/C_{sm}) \log (A°/A)$
283.15	0.0	46.40	-
	0.1572	44.02	0.1455
	0.5432	38.50	0.1492
	1.2667	30.29	0.1462
	2.3362	21.80	0.1404
293.15	0.0	36.90	-
	0.3277	33.33	0.1349
	0.7173	29.16	0.1425
	1.1361	26.04	0.1333
	2.3068	19.41	0.1209
303.15	0.0	30.74	-
	0.3360	27.88	0.1262
	0.5632	26.09	0.1265
	1.1938	21.84	0.1244
	2.1461	16.94	0.1206
313.15	0.0	26.68	-
	0.3153	24.40	0.1230
	0.6936	22.01	0.1205
	1.2513	19.29	0.1126
	2.2377	15.27	0.1083

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The precision microgasometric apparatus described earlier (1) is used.

The argon solubility is reported as the "solvomolal absorption coefficient, A_{sm}." It is defined as the volume of pure gas at partial pressure of 101.325 kPa and normal conditions, absorbed by the quantity of solvent which contains 55.51 moles of D_2O.

It is calculated from the formula

$$A_{sm} = \frac{\alpha(55.51\, M_{r,2} + C_{sm,p-p} M_{r,3})}{\rho_{p-p}}$$

where α is the Bunsen coefficient,
ρ_{p-p} is the solution density, g ml^{-1},
$M_{r,2}$ and $M_{r,3}$ are the D_2O and salt molecular weights, respectively, and
$C_{sm,p-p}$ is mol salt (55.51 mol $D_2O)^{-1}$.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially purified sample, designated MRTU-6-02-376-66, with total impurities not exceeding 0.015%.
2. Water-d_2. 99.8 atom % D.
3. Salt. Chemically pure.

ESTIMATED ERROR:

$\delta A/A = 0.002$ (authors)

REFERENCES:

1. Strakov, A. N.; Krestov, G. A.; Abrosimov, V. K.; Badelin, V. G. *Zh. Fiz. Khim.* 1975, *49*, 1583.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water-d_2; 7789-20-0
3. Sodium Iodide; NaI; 7681-82-5

ORIGINAL MEASUREMENTS:

Abrosimov, V. K.; Badelin, V. G.; Krestov, G. A.

Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1977, 20, 1864 - 1866.

VARIABLES:

T/K: 283.15 - 313.15
P/kPa: 101.325 (1 atm)
NaI/mol $(55.51 \text{ mol } D_2O)^{-1}$: 0-2.3982

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Sodium Iodide/mol $(55.51 \text{ mol } D_2O)^{-1}$	Argon Solubility A_{sm}	Salt Effect Parameter $k = (1/C_{sm}) \log (A°/A)$
283.15	0.0	46.40	-
	0.3019	41.83	0.1492
	0.7255	36.30	0.1469
	1.3317	29.88	0.1435
	2.1122	23.57	0.1393
293.15	0.0	36.90	-
	0.3371	33.64	0.1192
	0.6628	30.64	0.1218
	1.3673	24.94	0.1244
	2.3982	18.80	0.1221
303.15	0.0	30.74	-
	0.4168	27.61	0.1119
	0.4573	27.26	0.1141
	1.1964	23.07	0.1042
	2.0201	18.82	0.1055
313.15	0.0	26.68	-
	0.3123	25.07	0.0866
	0.6811	23.04	0.0935
	1.5363	19.04	0.0954
	1.9210	17.52	0.0951

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The precision microgasometric apparatus described earlier (1) is used.

The argon solubility is reported as the "solvomolal absorption coefficient, A_{sm}." It is defined as the volume of pure gas at partial pressure of 101.325 kPa and normal conditions, absorbed by the quantity of solvent which contains 55.51 moles of D_2O.

It is calculated from the formula

$$A_{sm} = \frac{\alpha(55.51\, M_{r,2} + C_{sm,p-p}M_{r,3})}{\rho_{p-p}}$$

where α is the Bunsen coefficient,
ρ_{p-p} is the solution density, g ml^{-1},
$M_{r,2}$ and $M_{r,3}$ are the D_2O and salt molecular weights, respectively, and
$C_{sm,p-p}$ is mol salt $(55.51 \text{ mol } D_2O)^{-1}$.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially purified sample, designated MRTU-6-02-376-66, with total impurities not exceeding 0.015%.
2. Water-d_2. 99.8 atom % D.
3. Salt. Chemically pure.

ESTIMATED ERROR:

δA/A = 0.002 (authors)

REFERENCES:

1. Strakov, A. N.; Krestov. G. A.; Abrosimov, V. K.; Badelin, V. G. Zh. Fiz. Khim. 1975, 49, 1583.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water-d_2; D_2O; 7789-20-0
3. Potassium Bromide; KBr; 7785-02-3

ORIGINAL MEASUREMENTS:

Abrosimov, V. K.; Badelin, V. G.; Krestov, G. A.

Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1977, 20, 1864-1866.

VARIABLES:

T/K: 283.15 - 313.15
P/kPa: 101.325 (1 atm)
KBr/mol (55.51 mol $D_2O)^{-1}$: 0-2.6477

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Potassium Bromide/mol (55.51 mol $D_2O)^{-1}$	Argon Solubility A_{sm}	Salt Effect Parameter $K = (1/C_{sm}) \log (A°/A)$
283.15	0.0	46.40	-
	0.2932	42.20	0.1405
	0.6842	37.45	0.1360
	1.2666	31.62	0.1315
	2.3760	23.86	0.1216
293.15	0.0	36.90	-
	0.2920	34.10	0.1174
	0.6478	31.13	0.1140
	1.1583	27.29	0.1131
	2.6477	18.96	0.1092
303.15	0.0	30.74	-
	0.2774	28.77	0.1037
	0.6872	25.81	0.1105
	1.2930	22.57	0.1038
	2.2448	18.36	0.0997
313.15	0.0	26.68	-
	0.2878	25.09	0.0927
	0.6562	23.11	0.0951
	1.2689	20.46	0.0909
	2.2241	16.96	0.0885

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The precision microgasometric apparatus described earlier (1) is used.

The argon solubility is reported as the "solvomolal absorption coefficient, A_{sm}." It is defined as the volume of pure gas at partial pressure of 101.325 kPa and normal conditions, absorbed by the quantity of solvent which contains 55.51 moles of D_2O.

It is calculated from the formula

$$A_{sm} = \frac{\alpha(55.51\, M_{r,2} + C_{sm,p-p}M_{r,3})}{\rho_{p-p}}$$

where α is the Bunsen coefficient,
ρ_{p-p} is the solution density, g ml^{-1},
$M_{r,2}$ and $M_{r,3}$ are the D_2O and salt molecular weights, respectively, and
$C_{sm,p-p}$ is mol salt (55.51 mol $D_2O)^{-1}$.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially purified sample designated MRTU-6-02-376-66, with total impurities not exceeding 0.015%.
2. Water-d_2. 99.8 atom % D.
3. Salt. Chemically pure.

ESTIMATED ERROR:

$\delta A/A = 0.002$ (authors)

REFERENCES:

1. Strakov, A. N.; Krestov, G. A.; Abrosimov, V. K.; Badelin, V. G. Zh. Fiz. Khim. 1975, 49, 1583.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water-d_2; D_2O; 7789-20-0
3. Potassium Iodide; KI; 7681-11-0

ORIGINAL MEASUREMENTS:

Abrosimov, V. K.; Badelin, V. G.; Krestov. G. A.

Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1977, 20, 1864 - 1866.

VARIABLES:

T/K: 283.15 - 313.15
P/kPa: 101.325 (1 atm)
KI/mol (55.51 mol $D_2O)^{-1}$: 0 - 2.3613

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Potassium Iodide/mol (55.51 mol $D_2O)^{-1}$	Argon Solubility A_{sm}	Salt Effect Parameter $k = (1/C_{sm}) \log (A°/A)$
283.15	0.0	46.40	-
	0.2458	43.06	0.1320
	0.6899	37.57	0.1329
	1.1170	33.21	0.1300
	1.8355	27.53	0.1235
293.15	0.0	36.90	-
	0.2868	34.38	0.1071
	0.7058	30.90	0.1092
	1.3792	26.03	0.1099
	2.2743	21.43	0.1038
303.15	0.0	30.74	-
	0.2845	28.74	0.1027
	0.7008	26.27	0.0974
	1.2538	23.09	0.0991
	2.3613	18.65	0.0919
313.15	0.0	26.68	-
	0.3322	25.21	0.0741
	0.6554	23.53	0.0833
	1.2936	20.77	0.0841
	2.2325	17.79	0.0788

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The precision microgasometric apparatus described earlier (1) is used.

The argon solubility is reported as the "Solvomolal absorption coefficient, A_{sm}." It is defined as the volume of pure gas at partial pressure of 101.325 kPa and normal conditions, absorbed by the quantity of solvent which contains 55.51 moles of D_2O.

It is calculated from the formula

$$A_{sm} = \frac{\alpha(55.51\,M_{r,2} + C_{sm,p-p}M_{r,3})}{\rho_{p-p}}$$

where α is the Bunsen coefficient,

ρ_{p-p} is the solution density, g ml^{-1},

$M_{r,2}$ and $M_{r,3}$ are the D_2O and salt molecular weights, respectively, and

$C_{sm,p-p}$ is mol salt (55.51 mol $D_2O)^{-1}$.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially purified sample, designated MRTU-6-02-376-66, with total impurities not exceeding 0.015%.
2. Water-d_2. 99.8 atom % D.
3. Salt. Chemically pure

ESTIMATED ERROR:

$\delta A/A = 0.002$ (authors)

REFERENCES:

1. Strakov, A. N.; Krestov, G. A.; Abrosimov, V. K.; Badelin, V. G. Zh. Fiz. Khim. 1975, 49, 1583.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water-d_2; D_2O; 7789-20-0
3. Cesium Chloride; CsCl; 7647-17-8

ORIGINAL MEASUREMENTS:

Abrosimov, V. K.; Badelin, V. G.; Krestov, G. A.

Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1977, 20, 1864 - 1866.

VARIABLES:

T/K: 283.15 - 313.15
P/kPa: 101.325 (1 atm)
CsCl/mol (55.51 mol D_2O)$^{-1}$: 0-2.6544

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Cesium Chloride/mol (55.51 mol D_2O)$^{-1}$	Argon Solubility A_{sm}	Salt Effect Parameter $k = (1/C_{sm}) \log (A°/A)$
283.15	0.0	46.40	-
	0.3152	42.44	0.1229
	0.6591	38.43	0.1177
	1.3809	32.35	0.1134
	2.4718	25.70	0.1038
293.15	0.0	36.90	-
	0.2779	34.51	0.1046
	0.5910	31.91	0.1068
	1.2283	27.79	0.1003
	2.3145	22.62	0.0918
303.15	0.0	30.74	-
	0.3970	28.27	0.0916
	0.7458	26.10	0.0953
	1.3052	23.46	0.0899
	2.6544	18.50	0.0831
313.15	0.0	26.68	-
	0.3618	24.82	0.0867
	1.1447	21.75	0.0775
	1.3095	21.02	0.0791
	2.1151	18.43	0.0760

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The precision microgasometric apparatus described earlier (1) is used.

The argon solubility is reported as the "Solvomolal absorption coefficient, A_{sm}." It is defined as the volume of pure gas at parital pressure of 101.325 kPa and normal conditions, absorbed by the quantity of solvent which contains 55.51 moles of D_2O.

It is calculated from the formula

$$A_{sm} = \frac{\alpha(55.51\, M_{r,2} + C_{sm,p-p} M_{r,3})}{\rho_{p-p}}$$

where α is the Bunsen coefficient,
ρ_{p-p} is the solution density, g ml^{-1},
$M_{r,2}$ and $M_{r,3}$ are the D_2O and salt molecular weights, respectively, and
$C_{sm,p-p}$ is mol salt (55.51 mol D_2O)$^{-1}$.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially purified sample, designated MRTU-6-02-376-66, with total impurities not exceeding 0.015%.
2. Water-d_2. 99.8 atom % D.
3. Salt. Chemically pure.

ESTIMATED ERROR:

$\delta A/A = 0.002$ (authors)

REFERENCES:

1. Strakov, A. N.; Krestov, G. A.; Abrosimov, V. K.; Badelin, V. G. Zh. Fiz. Khim. 1975, 49, 1583.

COMPONENTS:

1. Argon; Ar; 74403-7-1
2. Water-d_2; D_2O; 7789-20-0
3. Cesium Bromide; CsBr; 7787-69-1

ORIGINAL MEASUREMENTS:

Abrosimov, V. K.; Badelin, V. G.; Krestov, G. A.

Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1977, 20, 1864 - 1866.

VARIABLES:

T/K: 283.15 - 313.15
P/kPa: 101.325 (1 atm)
CsBr/mol (55.51 mol $D_2O)^{-1}$: 0-2.6713

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Cesium Bromide/mol (55.51 mol $D_2O)^{-1}$	Argon Solubility A_{sm}	Salt Effect Parameter $k = (1/C_{sm}) \log (A°/A)$
283.15	0.0	46.40	-
	0.2564	43.32	0.1163
	0.6260	39.30	0.1152
	1.2141	34.18	0.1093
	2.2437	27.42	0.1018
293.15	0.0	36.90	-
	0.2626	34.84	0.0950
	0.5314	32.65	0.1000
	1.0228	29.47	0.0955
	2.0919	24.07	0.0887
303.15	0.0	30.74	-
	0.2701	29.38	0.0728
	0.7004	26.58	0.0902
	1.3315	23.63	0.0858
	2.6713	19.15	0.0769
313.15	0.0	26.68	-
	0.3148	25.52	0.0613
	0.6238	23.87	0.0775
	1.0126	22.52	0.0727
	2.0249	19.39	0.0685

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The precision microgasometric apparatus described earlier (1) is used.

The argon solubility is reported as the "Solvomolal absorption coefficient, A_{sm}." It is defined as the volume of pure gas at partial pressure of 101.325 kPa and normal conditions, absorbed by the quantity of solvent which contains 55.51 moles of D_2O.

It is calculated from the formula

$$A_{sm} = \frac{\alpha(55.51\ M_{r,2} + C_{sm,p-p}M_{r,3})}{\rho_{p-p}}$$

where α is the Bunsen coefficient,
ρ_{p-p} is the solution density, g ml^{-1},
$M_{r,2}$ and $M_{r,3}$ are the D_2O and salt molecular weights, respectively, and
$C_{sm,p-p}$ is mol salt (55.51 mol $D_2O)^{-1}$.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially purified sample, designated MRTU-6-02-376-66, with total impurities not exceeding 0.015%.
2. Water-d_2. 99.8 atom % D.
3. Salt. Chemically pure.

ESTIMATED ERROR:

$\delta A/A = 0.002$ (authors)

REFERENCES:

1. Strakov, A. N; Krestov, G. A.; Abrosimov, V. K.; Badelin, V. G. Zh. Fiz. Khim. 1975, 49, 1583.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water-d_2; D_2O; 7789-20-0
3. Rubidium Chloride; RbCl; 7791-11-9

ORIGINAL MEASUREMENTS:

Abrosimov, V. K.; Badelin, V. G.; Krestov, G. A.

Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1977, 20, 1864 - 1866.

VARIABLES:

T/K: 283.15 - 313.15
P/kPa: 101.325 (1 atm)
RbCl/mol (55.51 mol $D_2O)^{-1}$: 0-2.5745

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Rubidium Chloride/mol (55.51 mol $D_2O)^{-1}$	Argon Solubility A_{sm}	Salt Effect Parameter $k = (1/C_{sm}) \log (A°/A)$
283.15	0.0	46.40	-
	0.3444	41.70	0.1347
	0.6385	38.25	0.1314
	1.2836	31.97	0.1260
	2.4813	23.95	0.1158
293.15	0.0	36.90	-
	0.2582	34.58	0.1092
	0.5216	32.12	0.1155
	1.0673	27.95	0.1150
	1.9297	22.98	0.1066
303.15	0.0	30.74	-
	0.3645	28.14	0.1053
	0.7764	25.46	0.1054
	1.2388	22.97	0.1021
	2.1990	18.92	0.0959
313.15	0.0	26.68	-
	0.3520	24.59	0.1006
	0.7620	22.47	0.0979
	1.3750	19.93	0.0921
	2.5745	15.93	0.0870

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The precision microgasometric apparatus described earlier (1) is used.

The argon solubility is reported as the "Solvomolal absorption coefficient, A_{sm}." It is defined as the volume of pure gas at partial pressure of 101.325 kPa and normal conditions, absorbed by the quantity of solvent which contains 55.51 moles of D_2O.

It is calculated from the formula

$$A_{sm} = \frac{\alpha(55.51\ M_{r,2} + C_{sm,p-p}M_{r,3})}{\rho_{p-p}}$$

where α is the Bunsen coefficient,
ρ_{p-p} is the solution density, g ml^{-1},
$M_{r,2}$ and $M_{r,3}$ are the D_2O and salt molecular weights, respectively, and
$C_{sm,p-p}$ is mol salt (55.51 mol $D_2O)^{-1}$.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially purified sample, designated MRTU-6-02-376-66, with total impurities not exceeding 0.015%.
2. Water-d_2. 99.8 atom % D.
3. Salt. Chemically pure.

ESTIMATED ERROR:

$\delta A/A = 0.002$ (authors)

REFERENCES:

1. Strakov, A. N.; Krestov, G. A.; Abrosimov, V. K.; Badelin, V. G. Zh. Fiz. Khim. 1975, 49, 1583.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Hydrated Aluminium Oxide; $Al_2O_3 \cdot x\ H_2O$;

ORIGINAL MEASUREMENTS:

Shkol'nikova, R. I.

Uch. Zap. Leningr. Gos. Univ., Ser. Khim. Nauk. 1959, Nr. 18, 64 - 86.

Chem. Abstr. 1961, 55, 25443b.

VARIABLES:

T/K: 293.15 - 313.15
P/kPa: 101.325 (1 atm)
Al_2O_3/Wt %: 0 - 0.35

PREPARED BY:

A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Hydrated Al_2O_3/Wt %	Bunsen Coefficient $\alpha \times 10^3$
293 15	0.35	27.7
303.15	0.35	25.2
313.15	0.35	22.2

The enthalpy of solution of argon from the temperature coefficient of the Bunsen coefficient is 2110 cal mol^{-1} in water and 2020 in the 0.35 wt % hydrated aluminium oxide solution.

The values for the solubility of argon in water were not given in the paper.

The hydrated aluminium oxide is described as a sol (colloidal).

AUXILIARY INFORMATION

METHOD:

APPARATUS/PROCEDURE:

The apparatus and procedure of Lannung (1) were modified.

SOURCE AND PURITY OF MATERIALS:

1. Argon. 99.9 per cent argon and 0.1 per cent nitrogen.

ESTIMATED ERROR:

REFERENCES:

1. Lannung, A.
J. Am. Chem. Soc. 1930, 52, 68.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Hydrated Ferric Oxide; $Fe_2O_3 \cdot xH_2O$;

ORIGINAL MEASUREMENTS:

Shkol'nikova, R. I.

Uch. Zap. Leningr. Gos. Univ., Ser. Khim. Nauk. 1959, Nr. 18, 64 - 86.

Chem. Abstr. 1961, 55, 25443b.

VARIABLES:

T/K: 293.15 - 313.15
P/kPa: 101.325 (1 atm)
Fe_2O_3/Wt %: 0 - 0.8

PREPARED BY:

A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Hydrated Fe_2O_3/Wt %	Bunsen Coefficient $\alpha \times 10^3$
293.15	0.1	24.2
303.15		22.3
313.15		17.4
293.15	0.5	21.7
303.15		18.9
313.15		15.8
293.15	0.8	15.6
303.15		13.8
313.15		11.8

The enthalpy of solution of argon from the temperture coefficient of the Bunsen coefficient is 2110 cal mol^{-1} in water and 3010, 2900 and 2550 cal mol^{-1} for the 0.1, 0.5 and 0.8 wt % hydrated ferric oxide solution, respectively.

The values for the solubility of argon in water were not given in the paper.

The hydrated ferric oxide is described as a sol (colloidal).

AUXILIARY INFORMATION

METHOD:

SOURCE AND PURITY OF MATERIALS:

1. Argon. 99.9 per cent argon and 0.1 per cent nitrogen.

APPARATUS/PROCEDURE:

The apparatus and procedure of Lannung were modified.

ESTIMATED ERROR:

REFERENCES:

1. Lannung, A. J. Am. Chem. Soc. 1930, 52, 68.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Methanol; CH_3OH; 67-56-1
3. Sodium Iodide; NaI; 7681-82-5

ORIGINAL MEASUREMENTS:

Clever, H. L.; Reddy, G. S.

J. Chem. Eng. Data 1963, 8, 191 - 192.

VARIABLES:

T/K: 303.15
P/kPa: 101.325 (1 atm)
Salt/mol dm^{-3}: 0 - 3.84

PREPARED BY:

S. A. Johnson

EXPERIMENTAL VALUES:

T/K	Sodium Iodide mol dm^{-3}	Ostwald Solubility Ratio L^o/L	Salt Effect Parameter $k_s \doteq (1/C)\log(L^o/L)$
303.15	0.0	1	-
	0.227	1.130	0.234
	0.762	1.230	0.118
	1.91	1.750	0.127
	2.47	2.135	0.133
	3.40	2.490	0.117
	3.84	3.155	0.130

The Bunsen coefficient in methanol was found to be 0.230.

The density of the NaI + methanol solutions was $\rho/g\ cm^{-3} = 0.781 + 0.129\ C$ where C is the NaI concentration in mol dm^{-3}.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The apparatus was modeled after that of Markham and Kobe (1). A length of TRUEBORE tubing of 0.4643 cm^2 cross-section was used as the gas buret. The volume of argon, presaturated with the solvent vapor, taken up by a 103.1 cm^3 sample of the solvent was measured.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Inc. Regular grade, 99.998 % pure.
2. Methanol. Merck & Co. Anhydrous grade. Used as received.
3. Sodium Iodidie. J. T. Baker Analyzed Reagent Grade. Used as received.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 3$
$\delta\alpha/\alpha = 0.015 - 0.025$

REFERENCES:

1. Markham, A. E.; Kobe, K. A. J. Am. Chem. Soc. 1941, 63, 449.

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. Water; H_2O; 7732-18-5 3. Polar Organic Compounds	H. L. Clever Department of Chemistry Emory University Atlanta, GA 30322 U.S.A. July 1979

CRITICAL EVALUATION:

In 1964 Ben-Naim and Baer (3) published the first careful study of the solubility of a gas in a binary water + organic compound mixed solvent. The paper on the solubility of argon in aqueous ethanol was interpreted in terms of the influence of alcohol on the water structure. The paper generated great interest. Since then several laboratories have contributed papers on the solubility of argon and other gases in aqueous-organic compound mixed solvents. There are now data on over 20 such systems.

Three laboratories have contributed most of the work on the systems. They are Ben-Naim and co-workers of the Hebrew University of Jerusalem, Israel; Krestov, Nedel'ko, Patsatsiya, Vinogradov and co-workers of the Ivanovo Chemical Technology Institute, USSR; and Morrison and Cargill of the Dundee College of Technology, U.K. In many of the papers the data were presented only in graphs. All three laboratories were contacted and asked if they would provide numerical data on the system reported only in graphs. Cargill sent numerical data which are used on the data sheets, Ben-Naim answered that the data were scattered in laboratory notebooks and would be too time consuming to collect, and the Russians did not answer the request. In the papers that contained large scale, well labelled graphs the compiler read numerical data from the graph for the data sheet (five systems). Most of the papers presented graphs that were unsuitable for direct reading and no data sheets were prepared for the papers.

There are problems with the gas solubility units in the papers of Krestov, et al. They report solubility in Ostwald coefficients and Ostwald coefficients at standard conditions. The later unit is not a conventional unit. We generally interpreted it to be a Bunsen coefficient, but there were papers in which it appears to be an absorption coefficient at some pressure other than atmospheric pressure. Krestov, et al. have used other units including the Bunsen coefficient, a unit of cm^3 gas at normal conditions per mole of solvent, and a new unit called solvomolality. The solvomolality unit is defined as the cm^3 gas at normal conditions and gas pressure of 101.325 kPa (1 atm) per 55.51 mole of solvent. On the data sheets the symbols and description of the unit as given in the paper are used.

In many of the Russian papers the solubility data are not tabulated, but shown only on a graph. In some of these papers the Gibbs energy of solution is tabulated. They define the Gibbs energy of solution for the transfer of one mole of gas from the gas phase at a concentration of one mole gas dm^{-3} to the hypothetical one molal gas solution (kg^{-1} solvent) as

$$\Delta G^\circ = - RT \ln (\gamma/\rho) + RT \ln (0.082\ T)$$

where γ is sometimes the Ostwald coefficient and sometimes the "Ostwald coefficient under standard conditions", and ρ is the solvent density. The definition follows from the early discussions of Eley (6) who used

$$\Delta G^\circ = - RT \ln (\text{Ostwald coefficient}) + RT \ln (0.082\ T)$$

for the Gibbs energy change of transfer of gas from the gas phase at one mole gas dm^{-3} to the solution of one mole gas dm^{-3}. The equation does not have the same thermodynamic significance when used with a Bunsen coefficient ("Ostwald coefficient under standard conditions"). Regardless of its meaning, in principle the tabulated Gibbs energy values could be used to calculate the argon solubility value. This was not done because of questions about the solubility unit, the solution density, and the way the Gibbs energy values were rounded off. Not all of the Russian papers were available to the Solubility Data Project in time for use in the compilation for this volume.

There are some comments below about each of the mixed solvent systems for which argon solubility data have been reported. This is more a guide to the literature than an evaluation. However, the Evaluator classes the data on these systems as tentative because the various workers have used different solubility units which makes comparison among their work difficult. Papers in which only a graph of the solubility data is presented are rejected, not because the data are necessarily poor, but because they are not of quantitative use to others.

1. Argon + Water + Methanol

Ben-Naim (1) reported the argon solubility over the entire concentration range at five degree intervals from 278.15 to 298.15 K. The data were presented on a graph which was read by the compiler for the data sheet. Krestov and Patsatsiya (22) reported a graph of the argon solubility over the entire concentration range at five degree intervals between 298.15 and 313.15 K. No data sheet was prepared. In another paper (31) they used the data to calculate thermodynamic characteristics of argon dissolution in solutions up to 0.8 mole fraction methanol at temperatures from 283 to 313 K.

2. Argon + Water + Ethanol

Ben-Naim and Baer (3) report on a graph the solubility of argon at nine ethanol mole fractions from 0.00 to 0.20 at six temperatures from 277.15 to 303.15 K. The graph was read by the compiler and a data sheet was prepared. Krestov and Nedel'ko (13) report the solubility of argon at 14 concentrations from 0.00 to 0.50 mole fraction alcohol at ten degree intervals from 303.15 to 343.15 K. They also calculated the number of molecules of argon per 100 molecules of solvent. For practical purposes this may be taken as the mole fraction times 100. See the data sheet. Krestov and Patsatsiya (22) show the solubility of argon in the system and the Gibbs energy of solution on graphs at five degree intervals from 298.15 to 313.15 K. No data sheet was prepared. Krestov, Nedel'ko, Vinogradov and Patsatsiya (31) discuss thermodynamic characteristics of argon dissolution in the system at ethanol mole fractions from 0.0 to 0.8 and temperatures from 283.15 to 313.15 K. Cargill and Morrison (5) report the solubility of argon at eight concentrations between 0.0 and 1.0 mole fraction ethanol at many temperatures between 277.75 and 336.95 K. See the data sheet. Lannung (37) reports the solubility of argon in 0.500 mole fraction ethanol at three temperatures. When his values are converted to suitable units they agree well with the work of both Cargill and Morrison (5) and Krestov and Nedel'ko (13).

3. Argon + Water + Methanol + Ethanol

Krestov and Vinogradov (25) report the solubility of argon 0.70 to 0.95 mole fraction water with various ratios of methanol and ethanol at temperatures of 283 - 313 K. The paper was not available and there is no data sheet.

4. Argon + Water + 1-Propanol

Krestov and Nedel'ko (11) report the solubility of argon in aqueous 1-propanol at six concentrations from 0.00 to 0.50 mole fraction alcohol and of 10 degree intervals from 303.15 to 343.15 K. See the data sheet.

5. Argon + Water + 2-Propanol

Krestov and Nedel'ko (12) report the solubility of argon at 15 concentrations from 0.00 to 0.50 mole fraction 2-propanol at 10 degree intervals from 303.15 to 343.15 K. See the data sheet.

6. Argon + Water + 1-Butanol

7. Argon + Water + 2-Butanol

8. Argon + Water + 2-Methyl-1-propanol

Krestov, Nedel'ko and Slyusar (17) presented graphs of argon Bunsen coefficient values up to 0.04 mole fraction alcohol at up to six temperatures from 288.15 to 313.15 K. No data sheets were prepared.

9. Argon + Water + 2-Methyl-2-propanol

Cargill and Morrison (5) measured the solubility of argon at nine alcohol mole fractions from 0.00 to 0.84 and at many temperatures from 277.75 to 333.95 K. See data sheet. Krestov, Nedel'ko and Slyusar (17) show a small graph of the argon Bunsen coefficient at 15 alcohol mole fractions from 0.0 to 1.0 mole fraction alcohol at six temperatures from 283 to

313 K. No data sheet was prepared. The authors (35) studied the system further in a paper that was not available to us.

10. Argon + Water + 1,2-Ethanediol

Ben-Naim (2) measured the solubility of argon in water + 1,2-ethanediol at 11 concentrations of 1,2-ethanediol over the entire composition range at five temperatures from 278.15 to 298.15 K. The compiler read values from a graph to prepare a data sheet. Krestov and Nedel'ko (9, 31) show a small scale graph of the argon solubility up to a mole fraction of 0.25 at temperatures from 298.15 to 343.15 K and discuss the thermodynamic characteristics of argon dissolution in the system. No data sheet was prepared.

11. Argon + Water + Methanol + 1,2-Ethanediol

Krestov and Vinogradov (26) report the solubility of argon from 0.60 to 0.95 mole fraction water, 0.025 - 0.30 mole fraction methanol and 0.025 - 0.30 mole fraction 1,2-ethanediol at 10 degree intervals from 283.15 to 313.15 K. In a second paper (19) they discuss thermodynamic characteristics of the solution process. See the data sheet.

12. Argon + Water + 1,2,3-Propanetriol

Krestov and Nedel'ko (8) reported the solubility of argon in the system at 13 1,2,3-propanetriol mole fractions from 0.00 to 0.30 at seven temperatures from 313.15 to 343.15 K. A data sheet was prepared. Krestov, Patsatsiya and Vinogradov (23) reported on a small graph the argon solubility at 1,2,3-propanetriol mole fractions up to 0.25 and four temperatures from 293.15 to 313.15 K. No data sheet was prepared. Krestov, Nedel'ko, Vinogradov and Patsatsiya (31) used the solubility data to calculate thermodynamic characteristics of argon dissolution in the system at temperatures of 283.15 to 343.15 K and 1,2,3-propanetriol mole fractions up to 0.25.

13. Argon + Water + Methanol + 1,2,3-Propanetriol

Krestov and Vinogradov (26) studied the system at mole fractions of water from 0.70 to 0.95, methanol 0.025 to 0.30 and 1,2,3-propanetriol from 0.025 to 0.30, and at ten degree temperature intervals from 283.15 to 313.15 K. A data sheet was prepared. Krestov, Vinogradov, Nedel'ko, and Patsatsiya (34) discussed thermodynamic properties of argon in tricomponent water + alcohol solvents and Krestov and Vinogradov (19) discussed specifically the thermodynamics of argon dissolution of this system.

14. Argon + Water + 1,2-Ethanediol + 1,2,3-Propanetriol

Krestov and Vinogradov (18) report the solubility and thermodynamics of argon dissolution in the system of mole fractions of water from 0.75 to 0.95, of 1,2-ethanediol and 1,2,3-propanetriol from 0.025 to 0.20 at ten degree intervals from 283.15 to 313.15 K. A data sheet was prepared.

15. Argon + Water + 2,2′-Oxybisethanol

Krestov, Egorova, and Trostin (28) reported the solubility of argon at ten 2,2′-oxybisethanol mole fractions from 0.00 to 0.50 and at five degree intervals from 293.15 to 313.15 K. The data were presented in a graph which the compiler read to prepare a data sheet.

16. Argon + Water + 1,4-Dioxane

Ben-Naim and Moran (4) measured the solubility of argon at 14 mole fractions over the entire composition range at five degree intervals from 278.15 to 298.15 K. The data were presented in a graph which was read by the compiler to prepare a data sheet. Krestov and Nedel'ko (10) measured the solubility of argon at eight 1,4-dioxane mole fractions from 0.00 to 0.50 and at six temperatures from 298.15 to 343.15 K. The values of the Gibbs energy of solution were tabulated but the solubility values were presented in a small graph. No data sheet was prepared.

17. Argon + Water + 2-Propanone

Krestov, Patsatsiya and Vinogradov (23) show a small scale graph of the solubility of argon at 15 2-propanone mole fractions from 0.00 to 0.60 at five degree intervals from 298.15 to 313.15 K. No data sheet was prepared. The thermodynamic characteristics of argon dissolution in the system are discussed by Krestov and Nedel'ko (24). Several other papers of Krestov *et al*. report argon solubilities in the system in the presence of added electrolytes. The papers are referenced in the argon + water + electrolyte evaluation section.

18. Argon + Water + Formic Acid

Krestov, Nedel'ko and Zheleznyak (21) report graphically the solubility of argon at twelve formic acid mole fractions from 0.00 to 1.00 at temperatures of 288.15, 298.15, 308.15, and 323.15 K. The Gibbs energies of solution are tabulated. No data sheet was prepared. The system is discussed further, and velocity of sound data given by Krestov and Zheleznyak (27).

19. Argon + Water + Acetic Acid

Krestov, Nedel'ko and Zheleznyak (20) report the solubility of argon at twelve acetic acid mole fraction from 0.00 to 1.00 at temperatures of 288.15, 298.15, 308.15, and 323.15 K. A data sheet was prepared. Also see (27).

20. Argon + Water + Butanoic Acid

Zheleznyak and Krestov (28) report argon solubility values of argon at twelve butanoic acid mole fractions from 0.00 to 1.00 at temperatures of 288.15, 298.15, 308.15, and 323.15 K. A data sheet was prepared. The paper also contains velocity of ultrasound data on the system.

21. Argon + Water + Formamide

Krestov, Nedel'ko and Polishchuk (15) show the solubility of argon at nine formamide mole fractions from 0.00 to 1.00 at temperatures of 283.15, 288.15, 298.15, and 308.15 K on small graphs. The thermodynamic characteristics of solution are tabulated. No data sheet was prepared.

22. Argon + Water + Dimethylformamide

Krestov, Nedel'ko and Polishchuk (16) show the solubility of argon at sixteen dimethylformamide mole fractions at temperatures of 283.15, 288.15, 298.15, and 308.15 K on small scale graphs. Gibbs energy of solution and other thermodynamic characteristics are tabulated. The paper also contains data on the effect of added LiCl, NaCl, KCl, and CsCl on argon solubility in the system. No data sheet was prepared.

23. Argon + Water + Nitromethane

Friedman (7) reports the solubility of argon at 298.00 K in water, nitromethane, water saturated nitromethane, and nitromethane saturated water. See the data sheet.

The Ivanovo Research Institute group of Krestov, *et al*. is very active in the area of gas solubility in mixed solvents. Not *all of* their papers are readily available. The following papers probably do not contain additional solubility data, but they do give further information on the argon + water + organic component systems studied by the group. They discuss the mixed solvent systems (29), thermodynamic calculations (30), solubility coefficients (32) and temperature coefficients at solubility (33). They have calculated the change in heat capacity from their solubility data in the mixed solvent systems (14). A brief English summary of their work on aqueous alcohol systems is available (36).

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37. Lannung, A. J. Am. Chem. Soc. 1930, 52, 68.
38. Zheleznyak, N. I.; Krestov. G. A. Zh. Strukt. Khim 1978, 19, 818.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Methanol; CH_3OH; 67-56-1

ORIGINAL MEASUREMENTS:

Ben-Naim, A.

J. Phys. Chem. 1967, 71, 4002-4007.

VARIABLES:

T/K: 278.15 - 298.15
P/kPa: 101.325 (1 atm)
Mol Fraction/X_3: 0 - 1.00

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

Mol Fraction	Ostwald Coefficient*/L				
Methanol/X_3	278.15 K	283.15 K	288.15 K	293.15 K	298.15 K
0.00	0.04825	0.04325	0.0395	0.03675	0.03425
0.03	0.0510	0.04575	0.04175	0.0390	0.0370
0.06	0.0510	0.04675	0.0435	0.04125	0.0395
0.10	0.0510	0.0475	0.04475	0.0430	0.0415
0.15	0.05025	0.04775	0.0460	0.04475	0.0440
0.20	0.0510	0.04925	0.0480	0.0470	0.04675
0.25	0.0530	0.05175	0.05125	0.05125	0.0515
0.30	0.0560	0.0560	0.0560	0.05625	0.0570
0.50	0.088	0.090	0.091	0.093	0.095
0.70	0.146	0.146	0.148	0.150	0.154
0.90	0.221	0.222	0.224	0.226	0.228
1.00	0.264	0.266	0.268	0.268	0.270

* values read from graph in original paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The water-methanol mixes were prepared by weight, and each solution was degassed by evacuation. The saturation vessel is magnetically stirred, and is connected to a gas buret and a mano-, meter system. The entire apparatus is immersed in a water thermostat. No correction was made for the slight change in the composition of the solutions after degassing had occurred.

The apparatus (1) is constructed so that the gas has three entry points to the saturation vessel, two capillary tubes coming from the bottom of the vessel, and one at the top. Stirring of the liquid causes the level of the solution to rise, thus readings from the manometer, gas buret, and the vessel are noted before stirring. Readings taken after saturation is complete yield the amount of gas absorbed per volume of solution.

SOURCE AND PURITY OF MATERIALS:

No information given.

ESTIMATED ERROR:

Relative precision ± 0.20 - 0.25 over the entire range of mixtures (author).

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Argon; Ar; 7440-37-1 2. Ethanol or Ethyl alcohol; C_2H_5OH 64-17-5 3. Water; H_2O; 7732-18-5	Lannung, A. J. Am. Chem. Soc. 1930, 52, 68 - 80.
VARIABLES: T/K: 285.65 - 308.15 P/kPa: 101.325 (1 atm) Mole fraction: 0.500	PREPARED BY: P. L. Long H. L. Clever

EXPERIMENTAL VALUES:

T/K	Bunsen Coefficient α	Ostwald Coefficient L	Solubility/S_o cm3 Ar (STP) kg^{-1} solvent
285.65	0.109	0.114	125.
291.15	0.109	0.116	126.
308.15	0.110	0.124	129.

The above solubility values are in a solvent which is a mixture of "equivalent amounts" of ethanol and water. This apparently means a mole fraction of 0.500.

The compiler calculated the Ostwald and the cm^3 argon (STP) kg^{-1} solvent solubility values. The later can be compared directly with the values of Cargill and Morrison on the next page. The agreement between the two sets of data is satisfactory.

AUXILIARY INFORMATION

METHOD:

APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

1. Argon. Linde Liquid Air Factory. Contains 0.5 per cent by volume N_2.
2. Ethanol. Alcohol absolutes, pharm. dan. Distilled twice from over freshly prepared quicklime.
3. Water. Conductivity, $\kappa = 2 \times 10^{-7}$.

ESTIMATED ERROR:

$\delta T/K = 0.03$

REFERENCES:

1. von Antropoff, A. Z. Elektrochem. 1919, 25, 269.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Ethanol or Ethyl Alcohol: C_2H_5OH; 64-17-5

ORIGINAL MEASUREMENTS:

Ben-Naim, A.; Baer, S.

Trans. Faraday Soc. 1964, 60, 1736 - 1741.

VARIABLES:

T/K: 277.15 - 303.15
P/kPa: 101.325 (1 atm)
Ethanol/X_3: 0 - 0.20

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

Mol Fraction	Ostwald Coefficient*/L					
Ethanol/X_3	277.15K	281.15K	285.15K	289.15K	297.15K	303.15K
0.0	0.0495	0.045	0.0415	0.039	0.0345	0.032
0.015	0.051	0.0465	0.043	0.0405	0.0365	0.034
0.03	0.051	0.0465	0.0435	0.041	0.037	0.035
0.045	0.050	0.0465	0.043	0.041	0.0375	-
0.06	0.0485	0.045	0.0425	0.0405	0.0375	0.036
0.09	0.0445	0.0445	0.0405	0.039	0.0375	0.0365
0.12	0.042	0.0405	0.0385	0.0385	0.0375	0.037
0.15	0.041	0.0405	0.040	0.039	0.0395	0.0405
0.20	0.045	0.0455	0.0455	0.0455	0.0465	0.0485

*Ostwald coefficients read from graph in original paper by the compiler. Values were read to the nearest 0.0005.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A calibrated dissolution vessel contains degassed solvent. Gas is introduced wet from a calibrated gas buret system. Stirring the liquid forces it up to sidearms attached to the top of the flask and the liquid returns via a central tube. The amount of gas dissolved is determined via the gas burets. The entire apparatus is thermostated in a water bath. 97% of the gas dissolves in 30 min., the remainder in 4 hrs. of slow stirring (1).

SOURCE AND PURITY OF MATERIALS:

1. Argon. No information given.
3. Ethanol. No information given.

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.002$

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Ethanol; C_2H_6O; 64-17-5

EVALUATOR:

Krestov, G. A.; Nedel'ko, B. E.

Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1971, *14*, 1173-1177.

Mol Fraction Ethanol/X_3	303.15 K		313.15 K		323.15 K	
	molecules Ar 100 molec^{-1} solution x10^2	Ostwald Coefficient at P_{tot} = 1 atm $\gamma_o \times 10^3$	molecules Ar 100 molec^{-1} solution x10^2	Ostwald Coefficient at P_{tot} = 1 atm $\gamma_o \times 10^3$	molecules Ar 100 molec^{-1} solution x10^2	Ostwald Coefficient at P_{tot} = 1 atm $\gamma_o \times 10^3$
0.00	0.222	28.10	0.1975	24.50	0.1735	22.00
0.02	-	28.53	-	25.52	-	23.42
0.04	-	28.64	-	26.54	-	24.83
0.06	-	28.62	-	27.83	-	27.44
0.08	-	29.01	-	29.72	-	29.73
0.10	0.2895	30.02	0.2935	30.51	0.3150	32.72
0.15	-	34.83	-	36.74	-	39.91
0.20	0.4550	41.03	0.4970	44.83	0.5390	48.44
0.25	-	49.34	-	54.84	-	58.63
0.30	0.7575	59.42	0.8575	65.02	0.8870	69.02
0.35	-	70.24	-	76.01	-	80.03
0.40	1.1680	80.72	1.2603	86.73	1.312	90.73
0.45	-	92.02	-	97.83	-	103.02
0.50	1.6650	102.4	1.7580	108.04	1.823	112.31

	333.15 K		343.15 K	
0.00	0.1615	20.50	0.153	19.80
0.02	-	22.43	-	20.84
0.04	-	24.42	-	23.33
0.06	-	27.04	-	26.72
0.08	-	30.11	-	31.21
0.10	0.3290	34.02	0.340	35.34
0.15	-	44.03	-	46.83
0.20	0.600	54.02	0.634	57.02
0.25	-	65.01	-	68.11
0.30	0.9625	75.32	1.000	78.02
0.35	-	85.74	-	88.53
0.40	1.450	96.41	1.442	99.44
0.45	-	107.03	-	110.32
0.50	1.910	117.42	1.960	120.73

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Ethanol; C_2H_6O; 64-17-5

ORIGINAL MEASUREMENTS:

Krestov, G. A.; Nedel'ko, B. E.

Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1971, 14, 1173-1177.

VARIABLES:

T/K: 303.15 - 343.15
P/kPa: 101.325 (1 atm)
C_2H_6O/X: 0.00 - 0.50

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

see preceeding page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus is a modification of the apparatus of Ben-Naim and Baer (1). Modifications include a degassing vessel connected directly to the absorption cell, a bubbling vessel to presaturate the gas with solvent vapor, and means to maintain the gas supply at a constant pressure. The entire apparatus is immersed in a 400 liter water bath controlled to within 0.005 K (2,3).

The solvent is degassed by boiling four hours under vacuum. Degassed solvent is admitted to the 639 ml absorption cell. Gas, presaturated with solvent vapor, is admitted. After 30 minutes rapid stirring 98% of the gas is dissolved. Slow stirring is continued for 2 hours to insure equilibrium. The mixed solvent is prepared by weight. The composition is checked after the solution process by density and refractive index measurements.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially pure grade designated MRTU-6-02-377-66. Contained not more than 0.004% N_2 and 0.001% O_2
2. Water. Doubly distilled.
3. Ethanol.

ESTIMATED ERROR:

$\delta T/K = 0.005$
$\delta\gamma/\gamma = 0.002 - 0.004$

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.
2. Nedel'ko, B. E.; Krestov, G. A. Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1969, 12, 998.
3. Patsatsiya, K. M.; Krestov, G. A. Zh. Fiz. Khim. 1970, 44, 1835.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Ethanol or Ethyl Alcohol; C_2H_5OH; 64-17-5
3. Water; H_2O; 7732-18-5

ORIGINAL MEASUREMENTS:

Cargill, R. W.; Morrison, T. J.

J. Chem. Soc., Faraday Trans. I 1975, 71, 618 - 634.

EXPERIMENTAL VALUES:

Mol Fraction Ethanol/X_2	T/K	10^4 T^{-1}	log(S_o/cm^{3}kg^{-1})	S_o/cm^{3}kg^{-1}
0.00	277.75	36.01	1.670	46.8
0.00	279.75	25.77	1.645	44.2
0.00	283.85[a]	35.24	1.612	40.9
0.00	287.45[a]	34.79	1.570	37.2
0.00	291.35[a]	34.33	1.539	34.6
0.00	297.55[a]	33.61	1.493	31.1
0.00	298.55	33.50	1.484	30.5
0.00	302.95[a]	33.01	1.452	28.3
0.00	309.75[a]	32.28	1.413	25.9
0.00	312.55[a]	32.00	1.400	25.1
0.00	320.95[a]	31.14	1.364	23.1
0.00	329.45[a]	30.36	1.328	21.3
0.00	339.45[a]	29.46	1.306	20.2
0.008	277.85	36.00	1.679	47.8
0.021	277.85	36.00	1.683	48.2
0.044	277.85	36.00	1.690	49.0
0.065	288.85	34.62	1.582	38.2
0.065	293.05	34.12	1.554	35.8
0.065	305.05	32.79	1.494	31.2
0.065	313.05	31.96	1.471	29.6
0.065	319.65	31.29	1.449	28.1
0.065	336.95	29.68	1.423	26.5
0.105	277.85	36.00	1.619	41.6
0.105	287.65	34.77	1.563	36.6
0.105	293.15	34.12	1.547	35.2
0.105	298.05	35.56	1.532	34.0
0.105	308.55	32.41	1.503	31.8
0.105	318.05	31.45	1.498	31.5
0.105	322.85	30.97	1.491	31.0
0.105	333.05	30.03	1.491	31.0
0.220	293.35	34.10	1.681	48.0
0.220	307.55	32.52	1.699	50.0
0.220	317.65	31.49	1.725	53.1
0.415	288.25	34.70	1.994	98.6
0.415	297.95	33.57	1.988	97.3
0.415	318.15	31.44	2.017	104.1
0.513	288.65	34.65	2.119	132.
0.513	308.15	32.45	2.127	134
0.513	318.15	31.44	2.130	135
0.513	333.05	30.03	2.151	142
0.770	280.55	35.65	2.325	211
0.770	283.05	35.34	2.326	212
0.770	290.35	34.45	2.322	210
0.770	298.25	25.54	2.321	209
0.770	308.15	32.45	2.328	213
0.770	312.65	31.99	2.332	215
0.770	322.55	31.00	2.343	220
0.770	332.25	30.10	2.348	223

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Ethanol or Ethyl Alcohol; C_2H_5OH; 64-17-5
3. Water; H_2O; 7732-18-5

ORIGINAL MEASUREMENTS:

Cargill, R. W.; Morrison, T. J.

J. Chem. Soc., Faraday Trans I. 1975, 71, 618-634.

VARIABLES:

T/K: 277.75 - 336.95

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

Mol Fraction Ethanol/X_2	T/K	10^4 T^{-1}	$\log(S_o/cm^3kg^{-1})$	S_o/cm^3kg^{-1}
0.998	288.65	34.65	2.495	313
0.998	293.05	34.25	2.491	310
0.998	298.25	25.54	2.491	310
0.998	303.05	33.01	2.484	305
0.998	308.15	32.46	2.482	303
0.998	312.95	31.96	2.476	299
0.998	328.05	30.49	2.474	298
0.998	332.75	30.06	2.473	297

[a] Values from reference 3.

Dr. Cargill kindly provided the log S_o values for the use of the Solubility Data Project.

The Solubility, S_o, calculated as cm^3 gas at 273.15 K and Ar partial pressure of 1 atm per kg of solvent.

AUXILIARY INFORMATION

METHOD: Absorption of gas by a thin film of liquid. The Morrison and Billett (1) method was modified by replacing valve A with a constant flow pump, and by measuring the mass of the solvent leaving the absorption tube (instead of the volume) on a top-pan balance.

APPARATUS/PROCEDURE: The solvent is degassed using the vapor pump principle (1). Each determination absorbs about 20 cm^3 of gas in up to 500 cm^3 of solvent, which was recycled. The density of the solvent was checked after each run, so that the exact composition of the solution could be determined (2).

SOURCE AND PURITY OF MATERIALS:

1. Argon. British Oxygen Co. Gas 99.9 per cent pure, stored over saturated brine.
2. Ethanol. Source not given. Spectroscopic grade.
3. Water. Deionized.

ESTIMATED ERROR:

$\delta T/K = 0.1$

$\delta P/mmHg = 0.5$

Solubility values reproducible within 0.5 per cent (authors).

REFERENCES:

1. Morrison, T. J.; Billett, F. J.Chem.Soc. 1948, 2033; 1952,3819.
2. International Critical Tables, Volume III, pp 112 - 118.
3. Morrison, T. J.; Johnstone, N. B. J. Chem. Soc. 1954, 3441.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. 1-Propanol; C_3H_8O; 71-23-8

ORIGINAL MEASUREMENTS:

Krestov, G. A.; Nedel'ko, B. E.

Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1970, 13, 490 - 493.

VARIABLES:

T/K: 303.15 - 343.15
P/kPa: 101.325 (1 atm)
C_3H_8O/X_3: 0.0 - 0.50

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

Mol Fraction 1-Propanol X_3	Ostwald coefficient at temperature T/γ'_T *				
	303.15 K	313.15 K	323.15 K	333.15 K	343.15 K
0.00	32.0	29.7	29.7	31.2	35.7
0.10	36.4	41.8	50.6	70.7	99.8
0.20	54.1	70.7	85.6	117.2	163.7
0.30	97.0	114.7	131.0	180.1	250.9
0.40	126.9	145.0	149.7	215.7	298.37
0.50	144.2	162.4	187.2	235.2	327.5

	Ostwald coefficient at standard conditions/γ'_0 *				
0.00	28.8	25.9	24.9	25.5	28.3
0.10	32.8	36.4	42.8	57.9	79.2
0.20	48.7	61.6	72.3	96.1	129.9
0.30	88.3	99.9	123.1	147.6	199.1
0.40	114.3	126.4	126.5	176.8	236.8
0.50	129.9	141.6	158.2	193.3	259.9

*In the notation of Krestov and Nedel'ko the symbol γ' refers to ml gas dm^{-3} of solvent. The Ostwald coefficient at standard conditions probably is the Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus is a modification of the apparatus of Ben-Naim and Baer (1). Modifications include a degassing vessel connected directly to the absorption cell, a bubbling vessel to presaturate the gas with solvent vapor, and means to maintain the gas supply at a constant pressure. The entire apparatus is immersed in a 400 liter water bath controlled to within 0.005 K (2,3).

The solvent is degassed by boiling four hours under vacuum. Degassed solvent is admitted to the 639 ml absorption cell. Gas, presaturated with solvent vapor, is admitted. After 30 minutes rapid stirring 98% of the gas is dissolved. Slow stirring is continued for 2 hours to insure equilibrium. The mixed solvent is prepared by weight. The composition is checked after the solution process by density and refractive index measurements.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially pure grade designated MRTU-6-02-377-66. Contained not more than 0.004% N_2 and 0.001% O_2.
2. Water. Doubly distilled.
3. 1-Propanol.

ESTIMATED ERROR:

δT/K = 0.005
δγ/γ = 0.002 - 0.004

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.
2. Nedel'ko, B. E.; Krestov, G. A. Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1969, 12, 998.
3. Patsatsiya, K. M.; Krestov, G. A. Zh. Fiz. Khim. 1970, 44, 1835.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. 2-Propanol or Isopropyl alcohol; C_3H_8O; 67-63-0

ORIGINAL MEASUREMENTS:

Krestov, G. A.; Nedel'ko, B. E.

Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1971, 14, 1006 - 1009.

VARIABLES:

T/K: 303.15 - 343.15
P/kPa: 101.325 (1 atm)
C_3H_8O/X : 0.0 - 0.50

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

Mol Fraction 2-Propanol X_3	Ostwald coefficient at standard conditions*/γ_0x 10^3				
	303.15	313.15	323.15	333.15	343.15
0.00	28.10	24.50	22.00	20.50	19.80
0.02	29.53	27.02	25.01	24.02	23.54
0.04	30.22	28.12	26.34	25.73	25.43
0.06	30.81	29.11	27.63	27.04	27.02
0.08	31.34	30.14	28.94	28.53	28.54
0.10	31.62	30.93	30.02	30.02	30.01
0.12	32.54	33.02	33.01	34.01	35.04
0.15	36.33	38.44	39.02	40.03	43.02
0.20	45.04	46.51	48.33	50.64	56.63
0.25	53.72	56.12	58.04	61.04	70.23
0.30	63.21	64.83	68.52	71.23	86.22
0.35	71.51	75.04	79.01	82.02	96.01
0.40	81.54	85.52	90.02	92.51	107.5
0.45	91.53	96.43	100.0	103.5	119.0
0.50	101.1	106.1	109.2	113.9	130.0

*The Evaluator is not sure what the authors mean by the term Ostwald coefficent at standard conditions. He assumes it is the Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus is a modification of the apparatus of Ben-Naim and Baer (1). Modifications include a degassing vessel connected directly to the absorption cell, a bubbling vessel to presaturate the gas with solvent vapor, and means to maintain the gas supply at a constant pressure. The entire apparatus is immersed in a 400 liter water bath controlled to within 0.005 K (2,3).

The solvent is degassed by boiling four hours under vacuum. Degassed solvent is admitted to the 639 ml absorption cell. Gas, presaturated with solvent vapor, is admitted. After 30 minutes rapid stirring 98% of the gas is dissolved. Slow stirring is continued for 2 hours to insure equilibrium. The mixed solvent is prepared by weight. The composition is checked after the solution process by density and refractive index measurements.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially pure grade designated MRTU-6-02-377-66. Contained not more than 0.004% N_2 and 0.001% O_2.
2. Water. Doubly distilled.
3. 2-Propanol.

ESTIMATED ERROR:

$\delta T/K = 0.005$
$\delta\gamma/\gamma = 0.002 - 0.004$

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.
2. Nedel'ko, B. E.; Krestov, G. A. Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1969, 12, 998.
3. Patsatsiya, K. M.; Krestov, G. A. Zh. Fiz. Khim. 1970, 44, 1835.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 2-Methyl-2-propanol or t-Butanol; C_4H_9OH; 75-65-0
3. Water; H_2O; 7732-18-5

ORIGINAL MEASUREMENTS:

Cargill, R. W.; Morrison, T. J.

J. Chem. Soc., Faraday Trans. I. 1975, 71, 618 - 634.

EXPERIMENTAL VALUES:

Mol Fraction Alcohol/X_2	T/K	10^4 T^{-1}	$\log(S_o/\mathrm{cm}^3\ \mathrm{kg}^{-1})$[b]	$S_o/\mathrm{cm}^3\ \mathrm{kg}^{-1}$ [c]
0.00	277.75	36.01	1.670	46.8
0.00	279.75	35.77	1.645	44.2
0.00	283.85[a]	35.24	1.612	40.9
0.00	287.45[a]	34.79	1.570	37.2
0.00	291.35[a]	34.33	1.539	34.6
0.00	297.55[a]	33.61	1.493	31.1
0.00	298.55	33.50	1.484	30.5
0.00	302.95[a]	33.01	1.452	28.3
0.00	309.75[a]	32.28	1.413	25.9
0.00	312.55[a]	32.00	1.400	25.1
0.00	320.95[a]	31.14	1.364	23.1
0.00	329.45[a]	30.36	1.328	21.3
0.00	339.45[a]	29.46	1.306	20.2
0.006	277.55	36.03	1.676	47.4
0.006	286.15	34.96	1.593	39.2
0.006	296.15	33.77	1.504	31.9
0.006	303.55	32.95	1.459	28.8
0.006	313.85	31.87	1.405	25.4
0.006	323.85	30.88	1.365	23.2
0.006	333.15	30.02	1.337	21.7
0.018	277.75	26.01	1.658	45.5
0.018	285.65	35.02	1.587	37.8
0.018	296.75	33.71	1.504	31.9
0.018	305.15	32.78	1.454	28.4
0.018	316.65	31.59	1.400	25.1
0.018	323.35	30.93	1.387	24.4
0.018	332.25	20.10	1.359	22.9
0.036	278.55	35.90	1.624	42.1
0.036	287.35	34.80	1.549	35.4
0.036	300.45	33.29	1.477	30.0
0.036	309.95	32.26	1.442	27.7
0.036	322.55	31.01	1.410	25.7
0.036	333.85	29.96	1.388	24.4
0.058	278.25	35.94	1.548	35.3
0.058	286.55	34.91	1.528	33.7
0.058	295.55	33.84	1.509	32.3
0.058	304.45	32.85	1.501	31.7
0.058	322.15	31.05	1.498	31.5
0.058	332.65	30.07	1.499	31.6
0.068	278.05	35.97	1.562	36.5
0.068	285.85	34.99	1.549	35.4
0.068	294.45	33.97	1.541	34.8
0.068	303.95	32.91	1.542	34.8
0.068	314.45	31.81	1.546	35.2
0.068	324.45	30.82	1.554	35.8
0.068	333.45	29.99	1.568	37.0
0.102	277.85	36.00	1.672	47.0
0.102	286.45	34.92	1.676	47.4
0.102	295.15	33.89	1.681	48.0
0.102	303.75	32.93	1.687	48.6
0.102	313.65	31.89	1.697	49.8
0.102	322.75	30.99	1.704	50.6
0.102	333.95	29.95	1.716	52.0

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 2-Methyl-2-propanol or *t*-Butanol; C_4H_9OH; 75-65-0
3. Water; H_2O; 7732-18-5

ORIGINAL MEASUREMENTS:

Cargill, R. W.; Morrison, T. J.

J. Chem. Soc., Faraday Trans I. 1975, *71*, 618 - 634.

VARIABLES:

T/K: 277.75 - 333.95
P/kPa: 101.325 (1 atm)

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

Mol Fraction Alcohol/X_2	T/K	10^4 T^{-1}	$\log(S_o/cm^3\ kg^{-1})^b$	$S_o/cm^3\ kg^{-1}$ c
0.183	278.05	35.97	1.922	83.6
0.183	286.85	34.87	1.924	83.9
0.183	298.95	33.46	1.935	86.1
0.183	310.25	32.24	1.945	88.1
0.183	321.95	31.06	1.946	88.3
0.183	333.25	30.01	1.957	90.6
0.356	277.75	36.01	2.215	164
0.356	287.35	34.80	2.214	164
0.356	303.55	32.95	2.213	163
0.356	312.85	31.97	2.211	163
0.356	322.95	30.97	2.217	165
0.356	333.65	29.98	2.223	167
0.840	286.35	34.93	2.491	310
0.840	295.15	33.89	2.491	310
0.840	303.25	32.98	2.489	308
0.840	313.35	31.96	2.488	308
0.840	323.75	30.89	2.491	310
0.840	333.35	30.00	2.492	311

[a] Values from reference 3.
[b] Dr. Cargill kindly provided the log S_o values for the use of the Solubility Data Project.
[c] The Solubility, S_o, calculated as cm^3 gas at 273.15 K and an Ar partial pressure at 101.325 kPa (1 atm) per kg of solvent.

AUXILIARY INFORMATION

METHOD: Absorption of gas by a thin film of liquid. The Morrison and Billett (1) method was modified by replacing valve A with a constant flow pump. and by measuring the mass of the solvent leaving the absorption tube (instead of the volume) on a top-pan balance.

SOURCE AND PURITY OF MATERIALS:

1. Argon. British Oxygen Co. Stored over saturated brine. 99.9 % Ar.
2. 2-Methyl-2-propanol. Reagent grade, 98 percent, boils 82 - 83 °C.
3. Water. Deionized.

APPARATUS/PROCEDURE: The solvent is degassed using the vapor pump principle (1). Each determination absorbs about 20 cm^3 of gas in up to 500 cm^3 of solvent, which was recycled. The density of the solvent was checked after each run, so that the exact composition of the solution could be determined (2).

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta P/mmHg = 0.5$
Solubilities reproducible within 0.5 per cent.

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033; 1952,3819
2. International Critical Tables, Volume III, pp 112 - 118.
3. Morrison, T. J.; Johnstone, N. B. J. Chem. *Soc.* 1954, 3441.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. 1,2-Ethanediol or Ethylene Glycol; $C_2H_6O_2$; 107-21-1

ORIGINAL MEASUREMENTS:

Ben-Naim, A.

J. Phys. Chem. 1968, 72, 2998 - 3001.

VARIABLES:

T/K: 278.15 - 298.15
P/kPa: 101.325 (1 atm)
1,2-Ethanediol/X_3: 0 - 1.00

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

Mol Fraction 1,2-Ethanediol X_3	Ostwald Coefficient*/L 278.15 K	283.15 K	288.15 K	293.15 K	298.15 K
0.0	0.048	0.0435	0.0395	0.0365	0.034
0.015	0.0465	0.042	0.0385	0.0355	0.0335
0.03	0.044	0.040	0.037	0.0345	0.032
0.06	0.040	0.0365	0.034	0.0325	0.0305
0.10	0.035	0.0335	0.0315	0.0295	0.029
0.20	0.0285	0.027	0.0265	0.0265	0.0255
0.30	0.025	0.025	0.025	0.025	0.025
0.40	-	0.025	0.025	0.025	0.0255
0.60	-	0.027	0.0285	0.029	0.029
0.80	-	0.032	0.0325	0.033	0.0335
1.00	-	-	0.0360	0.0365	0.0371

*Ostwald coefficients read from graph in original paper by compiler. Values read to the nearest 0.0005.

METHOD/APPARATUS/PROCEDURE:

A calibrated dissolution vessel contains degassed solvent. Gas is introduced wet from a calibrated gas buret system. Stirring the liquid forces it up to sidearms attached to the top of the flask and the liquid returns via a central tube. The amount of gas dissolved is determined via the gas burets. The entire apparatus is thermostated in a water bath. 97% of the gas dissolves in 30 min., the remainder in 4 hrs. of slow stirring (1).

SOURCE AND PURITY OF MATERIALS:

1. Argon. No information given.

3. 1,2-Ethanediol. Fluka's Pure Grade or Analar Grade. The first was used in most of the measurements.

ESTIMATED ERROR:

$$\delta X_1/X_1 = 0.002$$

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Methanol; CH_4O; 67-56-1
4. 1,2-Ethanediol or Ethylene Glycol; $C_2H_6O_2$; 107-21-1

ORIGINAL MEASUREMENTS:

Krestov, G. A.; Vinogradov, V. I.

Zh. Fiz. Khim. 1975, 49, 794.
Russ J. Phys. Chem. 1975, 49, 467.

VINITI No. 2950-74
Deposited 25th November 1974

VARIABLES:

T/K: 283.15 - 313.15
P/kPa: 101.325 (1 atm)
H_2O/X_2: 0.60 - 0.95
CH_4O/X_3: 0.025 - 0.30
$C_2H_6O_2/X_4$: 0.025 - 0.30

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

Solvent Composition Mol Fraction			Ostwald coefficient at standard conditions*/$\gamma_o \times 10^3$			
H_2O/X_2	CH_4O/X_3	$C_2H_6O_2/X_4$	283.15 K	293.15 K	303.15 K	313.15 K
0.95	0.025	0.025	40.25	34.50	29.60	25.55
0.90	0.075	0.025	41.65	36.30	31.45	27.50
0.90	0.05	0.05	38.55	33.15	29.70	26.85
0.90	0.025	0.075	35.30	30.40	27.75	25.55
0.85	0.10	0.05	39.10	34.65	31.15	29.70
0.85	0.075	0.075	36.40	32.50	29.75	27.50
0.85	0.05	0.10	33.70	30.35	28.35	25.40
0.80	0.15	0.05	40.35	37.45	34.20	32.65
0.80	0.10	0.10	36.35	32.05	29.55	28.15
0.80	0.05	0.15	29.75	28.70	26.40	24.85
0.70	0.25	0.05	46.50	46.0	45.35	45.60
0.70	0.20	0.10	36.50	36.60	36.75	37.90
0.70	0.15	0.15	30.00	30.70	31.30	32.50
0.70	0.10	0.20	26.10	26.85	27.30	28.00
0.70	0.05	0.25	26.35	26.80	26.00	26.60
0.60	0.30	0.10	46.65	46.50	47.60	48.90
0.60	0.20	0.20	37.60	36.05	34.80	33.70
0.60	0.10	0.30	26.50	27.90	20.00	30.20

*The Ostwald coefficient at standard conditions is probably the Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus is a modification of the apparatus of Ben-Naim and Baer (1). Modifications include a degassing vessel connected directly to the absorption cell, a bubbling vessel to presaturate the gas with solvent vapor, and means to maintain the gas supply at a constant pressure. The entire apparatus is immersed in a 400 liter water bath controlled to within 0.005 K (2,3).

The solvent is degassed by boiling four hours under vacuum. Degassed solvent is admitted to the 639 ml absorption cell. Gas, presaturated with solvent vapor, is admitted. After 30 minutes rapid stirring 98% of the gas is dissolved. Slow stirring is continued for 2 hours to insure equilibrium. The mixed solvent is prepared by weight. The composition is checked after the solution process by density and refractive index measurements.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially pure grade designated MRTU-6-02-377-66. Contained not more than 0.004% N_2 and 0.001% O_2.
2. Water. Doubly distilled.
3. Methanol.
4. 1,2-Ethanediol.

ESTIMATED ERROR:

$\delta T/K = 0.005$
$\delta\gamma/\gamma = 0.002 - 0.004$

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.
2. Nedel'ko, B. E.; Krestov, G. A. Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1969, 12, 998.
3. Patsatsiya, K. M.; Krestov, G. A. Zh. Fiz. Khim. 1970, 44, 1835.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. 1,2,3-Propanetriol or Glycerol: $C_3H_8O_3$; 56-81-5

ORIGINAL MEASUREMENTS:

Krestov, G. A.; Nedel'ko, B. E.

Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1969, 12, 1685 - 1691.

VARIABLES:

T/K: 313.15 - 343.15
P/kPa: 101.325 (1 atm)
$C_3H_8O_3/X_3$: 0 - 0.30

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

Mol Fraction 1,2,3-Propaetrial/X_3	Ostwald coefficient in Standard Conditions/γ_o x 10^{3*}						
	313.15 K	318.15 K	323.15 K	328.15 K	333.15 K	338.15 K	343.15 K
0.00	24.5	23.4	22.0	21.4	20.5	19.7	19.3
0.02	22.3	21.7	19.9	19.7	18.8	18.3	17.9
0.03	21.4	20.9	19.2	19.0	18.2	17.7	17.4
0.04	20.7	20.2	18.5	18.3	17.5	17.2	17.0
0.05	19.9	19.4	17.8	17.6	17.0	16.8	17.5
0.07	18.5	18.1	16.7	16.7	16.7	19.3	20.3
0.09	17.1	16.8	16.6	16.8	17.9	21.2	21.6
0.11	16.0	16.0	16.7	16.9	18.3	21.4	21.6
0.13	15.0	15.2	16.3	16.7	18.0	20.9	21.1
0.15	14.1	14.5	15.8	16.2	17.6	20.3	20.5
0.20	12.1	12.7	13.8	14.3	16.2	18.1	18.4
0.25	10.3	11.0	11.2	12.0	13.8	15.1	16.1
0.30	-	-	7.7	9.4	10.7	12.8	13.9

*The Ostwald coefficient under standard conditions is probably the Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus is a modification of the apparatus of Ben-Naim and Baer (1). Modifications include a degassing vessel connected directly to the absorption cell, a bubbling vessel to presaturate the gas with solvent vapor, and means to maintain the gas supply at a constant pressure. The entire apparatus is immersed in a 400 liter water bath controlled to within 0.005 K (2,3).

The solvent is degassed by boiling four hours under vacuum. Degassed solvent is admitted to the 639 ml absorption cell. Gas, presaturated with solvent vapor, is admitted. After 30 minutes rapid stirring 98% of the gas is dissolved. Slow stirring is continued for 2 hours to insure equilibrium. The mixed solvent is prepared by weight. The composition is checked after the solution process by density and refractive index measurements.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially pure grade designated MRTU-6-02-377-66. Contained not more than 0.004% N_2 and 0.001% O_2.
2. Water. Doubly distilled.
3. 1,2,3-Propanetriol.

ESTIMATED ERROR:

$\delta T/K = 0.005$
$\delta\gamma/\gamma = 0.002 - 0.004$

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.
2. Nedel'ko, B. E.; Krestov, G. A. Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1969, 12, 998.
3. Patsatsiya, K. M.; Krestov, G. A. Zh. Fiz. Khim. 1970, 44, 1835.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Methanol; CH_4O; 67-56-1
4. 1,2,3-Propanetriol or Glycerine; $C_3H_8O_3$; 56-81-5

ORIGINAL MEASUREMENTS:

Krestov, G. A.; Vinogradov, V. I.

<u>Zh</u>. <u>Fiz</u>. <u>Khim</u>. 1975, <u>49</u>, 794.
<u>Russ</u>. <u>J</u>. <u>Phys</u>. <u>Chem</u>. 1975, <u>49</u>, 467.

VINITI No. 2950-74
Deposited 25th November 1974

VARIABLES:

T/K: 283.15 - 313.15
P/kPa: 101.325 (1 atm)
H_2O/X_2: 0.70 - 0.95
CH_4O/X_3: 0.025 - 0.25
$C_3H_8O_3/X_4$: 0.025 - 0.25

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

Solvent Composition Mol Fraction			Ostwald coefficient at standard conditions/γ_0 x10^3			
H_2O/X_2	CH_4O/X_3	$C_3H_8O_3/X_4$	283.15 K	293.15 K	303.15 K	313.15 K
0.95	0.025	0.025	39.50	33.75	27.75	24.30
0.90	0.075	0.025	40.35	34.60	29.10	25.45
0.90	0.05	0.05	35.85	30.10	25.75	24.10
0.90	0.025	0.075	30.60	26.10	22.60	21.95
0.85	0.10	0.05	35.85	31.20	27.25	26.45
0.85	0.075	0.075	32.30	27.15	24.15	23.80
0.85	0.05	0.10	28.95	23.75	21.40	20.20
0.80	0.15	0.05	37.30	33.15	29.35	28.70
0.80	0.10	0.10	28.55	25.20	24.00	23.00
0.80	0.05	0.15	22.50	19.80	18.80	18.65
0.70	0.25	0.05	42.90	39.95	36.80	36.60
0.70	0.20	0.10	33.10	29.70	28.85	28.00
0.70	0.15	0.15	26.00	24.40	23.45	22.90
0.70	0.10	0.20	21.60	20.25	19.25	19.90
0.70	0.05	0.25	17.65	16.70	15.60	15.50

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus is a modification of the apparatus of Ben-Naim and Baer (1). Modifications include a degassing vessel connected directly to the absorption cell, a bubbling vessel to presaturate the gas with solvent vapor, and means to maintain the gas supply at a constant pressure. The entire apparatus is immersed in a 400 liter water bath controlled to within 0.005 K (2,3).

The solvent is degassed by boiling four hours under vacuum. Degassed solvent is admitted to the 639 ml absorption cell. Gas, presaturated with solvent vapor, is admitted. After 30 minutes rapid stirring 98% of the gas is dissolved. Slow stirring is continued for 2 hours to insure equilibrium. The mixed solvent is prepared by weight. The composition is checked after the solution process by density and refractive index measurements.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially pure grade designated MRTU-6-02-377-66. Contained not more than 0.004% N_2 and 0.001% O_2.
2. Water. Doubly distilled.
3. Methanol.
4. 1,2,3-Propanetriol or Glycerine.

ESTIMATED ERROR:

$\delta T/K = 0.005$
$\delta\gamma/\gamma = 0.002 - 0.004$

REFERENCES:

1. Ben-Naim, A.; Baer, S. <u>Trans</u>. <u>Faraday Soc</u>. 1963, <u>59</u>, 2735.
2. Nedel'ko, B. E.; Krestov, G. A. <u>Izv</u>. <u>Vyssh</u>. <u>Uchebn</u>. <u>Zaved</u>., <u>Khim</u>. <u>Khim</u>. <u>Tekhnol</u>. 1969, <u>12</u>, 998.
3. Patsatsiya, K. M.; Krestov, G. A. <u>Zh</u>. <u>Fiz</u>. <u>Khim</u>. 1970, <u>44</u>, 1835.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. 1,2-Ethanediol; $C_2H_6O_2$; 107-21-1
4. 1,2,3-Propanetriol; $C_3H_8O_3$; 56-81-5

ORIGINAL MEASUREMENTS:

Krestov, G. A.; Vinogradov, V. I.

Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1976, 19, 412 - 416.

VARIABLES:

T/K: 283.15 - 313.15
P/kPa: 101.325
H_2O/X_2: 0.75 - 0.95
$C_2H_6O_2/X_3$: 0.025 - 0.20
$C_3H_8O_3/X_4$: 0.025 - 0.20

PREPARED BY:

A. L. Cramer
H. L. Clever

EXPERIMENTAL VALUES:

Solvent Composition Mol Fraction			Ostwald coefficient at standard conditions/$\gamma_o \times 10^{3*}$			
H_2O/X_2	$C_2H_6O_2/X_3$	$C_3H_8O_3/X_4$	283.15 K	293.15 K	303.15 K	313.15 K
0.95	0.025	0.025	34.45	29.30	25.50	23.60
0.90	0.075	0.025	29.80	25.90	24.15	22.50
0.90	0.05	0.05	28.00	24.60	22.50	21.30
0.90	0.025	0.075	26.50	23.30	21.20	20.10
0.85	0.10	0.05	25.50	23.10	20.90	20.30
0.85	0.075	0.075	24.25	21.80	19.70	19.10
0.85	0.05	0.10	23.10	20.55	18.80	18.20
0.80	0.15	0.05	23.70	21.40	20.10	19.50
0.80	0.10	0.10	21.40	19.40	17.90	17.35
0.80	0.05	0.15	19.45	16.95	16.30	16.20
0.75	0.20	0.05	22.40	20.80	20.25	19.80
0.75	0.15	0.10	19.80	18.60	17.85	17.40
0.75	0.10	0.15	17.95	16.75	16.30	15.80
0.75	0.05	0.20	16.75	16.45	16.10	16.00

*The Ostwald coefficient under standrad conditions is probably the Bunsen coefficient.

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

The apparatus is a modification of the apparatus of Ben-Naim and Baer (1). Modifications include a degassing vessel connected directly to the absorption cell, a bubbling vessel to presaturate the gas with solvent vapor, and means to maintain the gas supply at a constant pressure. The entire apparatus is immersed in a 400 liter water bath controlled to within 0.005 K (2,3).

The solvent is degassed by boiling four hours under vacuum. Degassed solvent is admitted to the 639 ml absorption cell. Gas, presaturated with solvent vapor, is admitted. After 30 minutes rapid stirring 98% of the gas is dissolved. Slow stirring is continued for 2 hours to insure equilibrium. The mixed solvent is prepared by weight. The composition is checked after the solution process by density and refractive index measurements.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially pure grade designated MRTU-6-02-377-66. Contained not more than 0.004% N_2 and 0.001% O_2.
2. Water. Doubly distilled.
3. 1,2-Ethanediol.
4. 1,2,3-Propanetriol.

ESTIMATED ERROR:

$\delta T/K = 0.005$
$\delta \gamma/\gamma = 0.002 - 0.004$

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.
2. Nedel'ko, B. E.; Krestov, G. A. Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1969, 12, 998.
3. Patsatsiya, K. M.; Krestov, G. A. Zh. Fiz. Khim. 1970, 44, 1835.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. 2,2'-Oxybis-Ethanol or Diethylene Glycol; $C_4H_{10}O_3$; 111-46-6

ORIGINAL MEASUREMENTS:

Krestov, G. A.; Egorova, V. I.; Trostin, V. N.

Zh. Strukt. Khim. 1976, 17, 373 -375.
J. Struct. Chem. 1976, 17, 324 - 326.

VARIABLES:

T/K: 293.15 - 313.15
P/kPa: 101.325 (1 atm)
$C_4H_{10}O_3/X_3$: 0.0 - 0.50

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

Mol Fraction	Ostwald coefficient*/γ_T x 10^3				
$C_4H_{10}O_3/X_3$	293.15 K	298.15 K	303.15 K	308.15 K	313.15 K
0.00	35.8	33.6	30.8	28.8	26.6
0.05	30.0	27.8	26.2	24.5	23.2
0.10	26.2	24.5	23.3	22.5	21.8
0.15	23.5	22.2	21.6	21.2	21.0
0.20	21.6	21.1	20.8	20.6	20.4
0.30	20.6	20.4	20.3	20.2	20.2
0.35	20.0	20.3	20.4	20.5	20.8
0.40	20.3	20.6	21.0	21.2	21.6
0.45	20.8	21.3	21.8	22.4	22.9
0.50	21.3	22.0	22.7	23.4	24.2

*Values read from graphs in original paper. The pure water values are more uncertain than the other values.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus is a modification of the apparatus of Ben-Naim and Baer (1). Modifications include a degassing vessel connected directly to the absorption cell, a bubbling vessel to presaturate the gas with solvent vapor, and means to maintain the gas supply at a constant pressure. The entire apparatus is immersed in a 400 liter water bath controlled to within 0.005 K (2,3).

The solvent is degassed by boiling four hours under vacuum. Degassed solvent is admitted to the 639 ml absorption cell. Gas, presaturated with solvent vapor, is admitted. After 30 minutes rapid stirring 98% of the gas is dissolved. Slow stirring is continued for 2 hours to insure equilibrium. The mixed solvent is prepared by weight. The composition is checked after the solution process by density and refractive index measurements.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially pure grade designated MRTU-6-02-377-66. Contained not more than 0.004% N_2 and 0.001% O_2.
2. Water. Doubly distilled.
3. 2,2'-Oxybis-Ethanol.

ESTIMATED ERROR:

$\delta T/K = 0.005$
$\delta\gamma/\gamma = 0.002 - 0.004$

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.
2. Nedel'ko, B. E.; Krestov, G. A. Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1969, 12, 998.
3. Patsatsiya, K. M.; Krestov, G. A. Zh. Fiz. Khim. 1970, 44, 1835.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. 1,4-Dioxane; $C_4H_8O_2$; 123-91-1

ORIGINAL MEASUREMENTS:

Ben-Naim, A.; Moran, G.

Trans. Faraday Soc. 1965, 61, 821 - 825.

VARIABLES:

T/K: 278.15 - 298.15
P/kPa: 101.325 (1 atm)
1,4-Dioxane/X_3: 0 - 1.00

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

Mol Fraction	Ostwald Coefficient*/L				
1,4-Dioxane/X_3	278.15K	283.15K	288.15K	293.15K	298.15K
0.00	0.048	0.0435	0.0395	0.0365	0.034
0.015	0.046	0.0425	0.0395	0.037	0.035
0.03	0.045	0.0415	0.039	0.037	0.035
0.06	0.0415	0.0395	0.038	0.0365	0.0355
0.09	0.0405	0.039	0.038	0.0375	0.037
0.12	0.0400	0.0395	0.0395	0.039	0.039
0.15	0.0415	0.0415	0.042	0.042	0.0425
0.20	0.0465	0.047	0.0475	0.048	0.049
0.25	0.0525	0.054	0.055	0.056	0.057
0.30	0.060	0.061	0.0625	0.064	0.0655
0.4	0.076	0.078	0.088	0.082	0.084
0.6	0.106	0.110	0.112	0.115	0.118
0.8	0.130	0.134	0.138	0.142	0.146
1.0	-	-	0.162	0.167	0.172

*Ostwald coefficients read from graph in original paper by the compiler. Values read to nearest 0.0005.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

A calibrated dissolution vessel contains degassed solvent. Gas is introduced wet from a calibrated gas buret system. Stirring the liquid forces it up to sidearms attached to the top of the flask and the liquid returns via a central tube. The amount of gas dissolved is determined via the gas burets. The entire apparatus is thermostated in a water bath. 97% of the gas dissolves in 30 min., the remainder in 4 hrs. of stirring (1).

SOURCE AND PURITY OF MATERIALS:

1. Argon. No information.

3. 1,4-Dioxane. Source not given. Refluxed over KOH + Ag_2O for 48 hours, distilled.

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.002$

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Acetic Acid; CH_3COOH; 64-19-7

ORIGINAL MEASUREMENTS:

Krestov, G. A.; Nedel'ko, B. E. Zheleznyak, N. I.

Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1975, 18, 1893 - 1896.

EXPERIMENTAL VALUES:

Mol Fraction Acetic Acid x_3	Ostwald coefficient/γ x 10^3				Bunsen coefficient/γ_o x 10^3			
	288.15 K	298.15 K	308.15 K	323.15 K	288.15 K	298.15 K	308.15 K	323.15 K
0.00	36.2	30.6	25.3	19.4	34.3	28.0	22.4	16.4
0.05	30.1	28.1	25.5	21.2	28.5	25.7	22.6	17.9
0.1	31.0	29.1	27.0	23.5	29.4	26.7	23.9	19.9
0.2	36.9	34.5	32.5	28.2	35.0	31.6	28.8	23.8
0.3	46.9	44.6	41.9	37.4	44.5	40.9	37.1	31.6
0.4	59.5	56.9	53.8	47.8	56.4	52.1	47.7	40.4
0.5	72.4	69.3	65.8	59.3	68.6	63.5	58.3	50.1
0.6	85.6	82.8	78.8	70.8	81.1	75.8	69.8	59.8
0.7	102.4	98.8	93.9	85.0	97.1	90.5	83.2	71.8
0.8	126.6	122.0	117.0	106.0	120.0	111.8	103.7	89.6
0.9	149.1	144.7	139.8	129.0	141.3	132.5	123.9	109.0
1.0	182.2	177.9	172.4	160.4	172.7	163.0	152.7	135.5

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Acetic Acid; CH_3COOH; 64-19-7

ORIGINAL MEASUREMENTS:

Krestov, G. A.; Nedel'ko, B. E.
Zheleznyak, N. I.
Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1975, 18, 1893 - 1896.

VARIABLES:

T/K: 288.15 - 323.15
P/kPa: 101.325 (1 atm)
CH_3COOH/X_3: 0.0 - 1.0

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

See Preceeding Page

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

The apparatus is a modification of the apparatus of Ben-Naim and Baer (1). Modifications include a degassing vessel connected directly to the absorption cell, a bubbling vessel to presaturate the gas with solvent vapor, and means to maintain the gas supply at a constant pressure. The entire apparatus is immersed in a 400 liter water bath controlled to within 0.005 K (2,3).

The solvent is degassed by boiling four hours under vacuum. Degassed solvent is admitted to the 639 ml absorption cell. Gas presaturated with solvent vapor, is admitted. After 30 minutes rapid stirring 98% of the gas is dissolved. Slow stirring is continued for 2 hours to insure equilibrium. The mixed solvent is prepared by weight. The composition is checked after the solution process by density and refractive index measurements.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially pure grade designated MRTU-6-02-377-66. Contained not more than 0.004% N_2 and 0.001% O_2.
2. Water. Doubly distilled.
3. Acetic Acid.

ESTIMATED ERROR:

$\delta T/K = 0.005$
$\delta\gamma/\gamma = 0.002 - 0.004$

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.
2. Nedel'ko, B. E.; Krestov, G. A. Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1969, 12, 998.
3. Patsatsiya, K. M.; Krestov, G. A. Zh. Fiz. Khim. 1970, 44, 1835.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Butanoic Acid; $C_4H_8O_2$; 107-92-6

ORIGINAL MEASUREMENTS:

Zheleznyak, N. I.; Krestov, G. A.

Zh. Strukt. Khim. 1978, 19, 818 - 823.
J. Struct. Chem. 1978, 19, 704 - 709.

VARIABLES:

T/K: 288.15 - 323.15
P/kPa: 101.325 (1 atm)
$C_4H_8O_2/X_3$: 0.0 - 1.00

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Mol Fraction $C_4H_8O_2/X_3$	Argon Solubility, Solvomolality/C_{sm} x 10^3 (mol Ar at T and 760 mmHg)(55.51 mol solvent)$^{-1}$			
	288.15	298.15	308.15	323.15
0.00	1.644	1.450	1.203	1.004
0.05	1.992	1.761	1.545	1.174
0.10	2.913	2.651	2.430	1.918
0.20	5.280	4.971	4.580	3.933
0.30	8.211	7.767	7.258	6.368
0.40	11.99	11.48	10.91	9.609
0.50	16.25	15.64	15.03	13.39
0.60	21.53	20.85	19.83	18.14
0.70	27.15	26.40	25.38	23.14
0.80	33.49	32.66	31.56	29.01
0.90	40.61	39.81	38.82	36.03
1.00	49.06	49.09	48.41	47.57

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

The apparatus is a modification of the apparatus of Ben-Naim and Baer (1). Modifications include a degassing vessel connected directly to the absorption cell, a bubbling vessel to presaturate the gas with solvent vapor, and means to maintain the gas supply at a constant pressure. The entire apparatus is immersed in a 400 liter water bath controlled to within 0.005 K (2,3).

The solvent is degassed by boiling four hours under vacuum. Degassed solvent is admitted to the 639 ml absorption cell. Gas, presaturated with solvent vapor, is admitted. After 30 minutes rapid stirring 98% of the gas is dissolved. Slow stirring is continued for 2 hours to insure equilibrium. The mixed solvent is prepared by weight. The composition is checked after the solution process by density and refractive index measurements.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially pure grade designated MRTU-6-02-377-66. Contained not more than 0.004% N_2 and 0.001% O_2.
2. Water. Doubly distilled.
3. Butanoic Acid.

ESTIMATED ERROR:

$\delta T/K = 0.005$
$\delta \gamma/\gamma = 0.002 - 0.004$

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.
2. Nedel'ko, B. E.; Krestov, G. A. Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1969, 12, 998.
3. Patsatsiya, K. M.; Krestov, G. A. Zh. Fiz. Khim. 1970, 44, 1835.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Nitromethane; CH_3NO_2; 75-52-5

ORIGINAL MEASUREMENTS:

Friedman, H. L.

J. Am. Chem. Soc. 1954, 76, 3294 - 3297.

VARIABLES:

T/K: 287.95 - 298.00
P/kPa: 93.33 (700 mmHg)

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
Water			
287.95			0.0404
			0.0403
			0.0407
	0.0309	0.0384	0.0405 Av.
298.00			0.0342
			0.0338
	0.0251	0.0312	0.0340 Av.
Water saturated with nitromethane (ca. 4 mol %)(2)			
298.00			0.0317
			0.0317
		0.0291	0.0317 Av.
Nitromethane saturated with water (ca. 12 mol %)(2)			
298.00			0.139
			0.141
		0.128	0.140 Av.

The author reported Ostwald coefficients measured at about 700 mmHg. The Bunsen coefficient and mole fraction solubilities at 101.325 kPa (1 atm) were calculated by the compiler with the assumptions that the gas is ideal, and that Henry's law is obeyed.

The argon Ostwald coefficient at 298.00 K in dry nitromethane is 0.143.

AUXILIARY INFORMATION

METHOD: Gas absorption. The method was essentially that employed by Euken and Herzberg (1). Euken and Herzberg's method was modified by use of magnetic stirring and by use of electrical contacts in the mercury manometer to aid in balancing the pressure.

APPARATUS/PROCEDURE: The solvent was degassed by vacuum. The procedure, repeated 5 - 10 times, was to alternate 5 - 15 s evacuation and rapid stirring to produce cavitation. In the solubility measurement, gas presaturated with solvent vapor, was brought into contact with about 80 ml of solvent in the saturation vessel. Initial conditions were established by a time extrapolation. Solubility equilibrium was approached from both under- and super-saturation.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Linde Air Products Spectrograde.
2. Water. Conductivity water.
3. Nitromethane. Source not given. Dried by filtering at 253 K, distilled.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/mmHg = 0.3$
$\delta L/L = 0.03$

REFERENCES:

1. Euken, A.; Herzberg, G. Z. Phys. Chem. 1950, 195, 1.
2. Corelli, R. M. Aerotecnica 1950, 30, 32. Chem. Abstr. 1952, 46, 3370e.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Pentane; C_5H_{12}; 109-66-0

ORIGINAL MEASUREMENTS:

Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L.

Hung. J. Ind. Chem. 1976, 4, 269-280

VARIABLES:

T/K: 298.15 - 313.51
P/kPa: 101.325 (1 atm)

PREPARED BY:

S. A. Johnson

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	2.84	0.550	0.600
313.15	2.14	0.403	0.462

The mole fraction solubilities and the Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -14{,}643 + 97{,}876\ T$

The above equation reproduced exactly the two solubility values, but it is not recommended. Comparisons of the author's data with the values of others for argon + octane and argon + decane systems, indicates the 298.15 K solubility value is probably reliable, but that the 313.15 K solubility value may be up to 30 per cent low.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Volumetric method. The apparatus of Bodor, Bor, Mohai, and Sipos (1) was used.

SOURCE AND PURITY OF MATERIALS:

Both the gas and liquid were analytical grade reagents of Hungarian or foreign origin. No further information.

DATA CLASS:

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$ at 298.15 K

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
Veszpremi Vegyip. Egy. Kozl. 1957, 1, 55.
Chem. Abstr. 1961, 55, 3175h.

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. Hexane; C_6H_{14}; 110-54-3	H. L. Clever Chemistry Department Emory University Atlanta, Georgia 30322 U.S.A.

CRITICAL EVALUATION:

The solubility of argon in hexane at 101.325 kPa was measured in two laboratories. Clever, Battino, Saylor, and Gross (1) reported three solubility values between 288.15 and 313.75 K. Makranczy, Megyery-Balog, Rusz, and Patyi (2) reported solubility values at 298.15 and 313.15 K.

The Makranczy *et al.* value at 298.15 K is 2.0 per cent higher, and the 313.15 K value 16.7 percent lower than the Clever *et al.* solubility values. The Makranczy *et al.* 313.15 K argon solubility value appears to be low for all of the hydrocarbons. See the evaluation of argon in octane and argon in decane for further evidence.

The Clever *et al.* data and the Makranczy *et al.* value at 298.15 K were combined in a linear regression of Gibbs energy as a function of temperature to obtain a tentative set of thermodynamic functions and mole fraction solubility values for the argon in hexane system.

The tentative thermodynamic values for the transfer of one mole of argon from the gas at 101.325 kPa (1 atm) to the hypothetical unit mole fraction solution are

$$\Delta G°/\mathrm{J\ mol^{-1}} = -RT \ln X_1 = -2{,}843.6 + 59.272\ T$$

$$\text{Std. Dev. } \Delta G° = 26.4, \quad \text{Coef. Corr.} = 0.9991$$

$$\Delta H°/\mathrm{J\ mol^{-1}} = -2{,}843.6, \quad \Delta S°/\mathrm{J\ K^{-1}\ mol^{-1}} = -59.272$$

The recommended values of the mole fraction solubility at 101.325 kPa and the Gibbs energy of solution are given as a function of temperature in Table 1.

TABLE 1. Solubility of argon in hexane at 101.325 kPa. Tentative mole fraction solubility and Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/\mathrm{J\ mol^{-1}}$
288.15	2.63	14,236
293.15	2.57	14,532
298.15	2.52	14,828
303.15	2.48	15,128
308.15	2.43	15,421
313.15	2.39	15,717
318.15	2.35	16,014

The partial and apparent molal volumes of argon dissolved hexane reported by Masterton, Robins and Slowinski (3) and by Ng and Walkley (4) are in Table 2.

TABLE 2. Partial and apparent molal volumes of argon in hexane.

T/K	$V_1/\mathrm{cm^3\ mol^{-1}}$	$\Phi V_1/\mathrm{cm^3\ mol^{-1}}$	Reference
288.15	46.1 ± 1		4
298.15	51.5 ± 1		4
303.15		50 ± 2	3
308.15	53.5 ± 1		4

1. Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M. J. Phys. Chem. 1957, 61, 1078.
2. Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L. Hung. J. Ind. Chem. 1976, 4, 269.
3. Masterton, W. L.; Robins, D. A.; Slowinski, E. J. J. Chem. Eng. Data 1961, 6, 531.
4. Ng, W. Y.; Walkley, J. J. Phys. Chem. 1969, 73, 2274.

See page 273 for solubility data above 200 kPa (2 bar) on the system.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Hexane; C_6H_{14}; 110-54-3

ORIGINAL MEASUREMENTS:

Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M.

J. Phys. Chem. 1957, 61, 1078-1083.

VARIABLES:

T/K: 288.15 - 313.75
P/kPa: 101.325 (1 atm)

PREPARED BY:

P. L. Long
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
288.15	2.60	0.449	0.474
298.15	2.53	0.432	0.472
313.75	2.37	0.396	0.455

The solubility values were adjusted to a partial pressure of argon of 101.325 kPa by Henry's law.

The Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -\ RT \ln X_1 = -2778.4 + 59.093\ T$

Std. Dev. $\Delta G°$ = 15.3, Coef. Corr. = 0.9999

For the recommended Gibbs energy equation and the smoothed values of mole fraction solubility see the evaluation of the solubility of argon in hexane.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solvent is saturated with the gas as it flows through an 8 mm x 180 cm glass helix attached to a gas buret. The total pressure of solute gas plus solvent vapor is maintained at 1 atm as the gas is absorbed.

The apparatus is a modification of that of Morrison and Billett (1). The modifications include the addition of a helical storage for the solvent, a manometer for a constant reference pressure, and an extra buret for use with highly soluble gases. The solvent is degassed by a modification of the method of Baldwin and Daniel (2).

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co. Both standard and research grades were used with no difference in results
2. Hexane. Humphrey-Wilkinson Co., Inc. Shaken with H_2SO_4, washed, dried over sodium, distilled.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/mmHg = 3$
$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033; Ibid. 1952, 3819.
2. Baldwin, R. R.; Daniel, S. G. J. Appl. Chem. 1952, 2, 161.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Hexane; C_6H_{14}; 110-54-3

ORIGINAL MEASUREMENTS:

Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L.

Hung. J. Ind. Chem. 1976, *4*, 269-280.

VARIABLES:

T/K: 298.15 - 313.15
P/kPa: 101.325

PREPARED BY:

S. A. Johnson

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	2.56	0.437	0.477
313.15	2.04	0.340	0.390

The mole fraction solubilities and Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -11{,}751 + 89.029\ T$

The above equation reproduces exactly the two solubility values, but it is not recommended. Comparisons of the author's data with the values of others for argon + octane and argon + decane systems indicates the 298.15 K solubility value is probably reliable, but that the 313.15 K solubility value may be up to 30 per cent low.

See the evaluation sheet for this system for the recommended Gibbs energy equations and solubility values.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Volumetric method. The apparatus of Bodor, Bor, Mohai and Sipos (1) was used.

SOURCE AND PURITY OF MATERIALS:

Both the gas and liquid were analytical grade reagents of Hungarian or foreign origin. No further information.

DATA CLASS:

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$ at 298.15 K.

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G. *Veszpremi Vegyip. Egy. Kozl.* 1957, *1*, 55. *Chem. Abstr.* 1961, *55*, 3175h.

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. Heptane; C_7H_{16}; 142-82-5	H. L. Clever Chemistry Department Emory University Atlanta, Georgia 30322 U.S.A.

CRITICAL EVALUATION:

The solubility of argon in heptane at 101.325 kPa was reported by two laboratories. Clever, Battino, Saylor, and Gross (1) reported three solubility values between 288.15 to 313.45 K. Makranczy, Megyery-Balog, Rusz and Patyi (2) report solubility values at 298.15 and 313.15 K.

The Makranczy _et al_. solubility value at 298.15 K is 0.80 percent higher, and the 313.15 K solubility value is 20.2 percent lower than the Clever _et al_. values. The Makranczy _et al_. 313.15 K solubility value is consistently 20-30 percent lower than the values reported from other laboratories for the seven aliphatic hydrocarbons for which comparisons can be made. See the evaluations of argon + octane and argon + decane for comparisons with results from additional laboratories. It is possible there is an unknown, but systematic error in the 313.15 K data of Makranczy _et al_.

The solubility data of Clever _et al_. and the 298.15 K solubility value of Makranczy _et al_. were combined on a one to one weight basis to obtain a tentative equation and solubility values.

The tentative thermodynamic values for the transfer of one mole of argon from the gas at 101.325 kPa (1 atm) to the hypothetical unit mole fraction solution are

$$\Delta G°/\text{J mol}^{-1} = -RT \ln X_1 = -1246.52 + 54.007\ T$$

$$\text{Std. Dev. } \Delta G° = 10.5, \qquad \text{Coef. Corr.} = 0.9998$$

$$\Delta H°/\text{J mol}^{-1} = -1246.52, \qquad \Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -54.007$$

The recommended values of the mole fraction solubility at 101.325 kPa and the Gibbs energy of solution are given as a function of temperature in Table 1.

TABLE 1. Solubility of argon in heptane at 101.325 kPa. Tentative mole fraction solubility and Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/\text{J mol}^{-1}$
288.15	2.54	14,316
293.15	2.52	14,586
298.15	2.50	14,856
303.15	2.48	15,126
308.15	2.46	15,396
313.15	2.44	15,666
318.15	2.42	15,936

Walkley and Jenkins (3) report a partial molal volume of argon in heptane of 48.3 $cm^3\ mol^{-1}$ at 298.15 K by dilatometry. Popov and Dakin (4) report an apparent molal volume of argon in heptane of 50.7 $cm^3\ mol^{-1}$ at 298.15 K from density measurements over a pressure range.

1. Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M. _J. Phys. Chem._ 1957, _61_, 1078.
2. Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L. _Hung. J. Ind. Chem._ 1976, _4_, 269.
3. Walkley, J.; Jenkins, W. I. _Trans. Faraday Soc._ 1968, _64_, 19.
4. Popov, G. A.; Drakin, S. I. _Zh. Fiz. Khim._ 1974, _48_, 631.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Heptane; C_7H_{16}; 142-82-5

ORIGINAL MEASUREMENTS:

Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M.

J. Phys. Chem. 1957, 61, 1078 - 1083.

VARIABLES:

T/K: 288.15 - 313.45
P/kPa: 101.325 (1 atm)

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
288.15	2.53	0.390	0.411
298.15	2.50	0.380	0.415
313.45	2.43	0.363	0.416

The solubility values were adjusted to a partial pressure of argon of 101.325 kPa by Henry's law.

The Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -1220.5 + 53.935\ T$

Std. Dev. $\Delta G° = 6.9$, Coef. Corr. = 0.9999

For the recommended Gibbs energy equation and the smoothed values of mole fraction solubility see the evaluation of the solubility of argon in heptane

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The solvent is saturated with the gas as it flows through an 8 mm x 180 cm glass helix attached to a gas buret. The total pressure of solute gas plus solvent vapor is maintained at 1 atm as the gas is absorbed.

The apparatus is a modification of that of Morrison and Billett (1). The modifications include the addition of a helical storage for the solvent, a manometer for a constant reference pressure, and an extra buret for use with highly soluble gases. The solvent is degassed by a modification of the method of Baldwin and Daniel (2).

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co. Both standard and research grades were used with no difference in results.
2. Heptane. Phillips Petroleum Co. Pure grade, used as received.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/mmHg = 3$
$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc., 1948, 2033; ibid. 1952, 3819.
2. Baldwin, R. R.; Daniel, S. G. J. Appl. Chem. 1952, 2, 161.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Heptane; C_7H_{16}; 142-82-5

ORIGINAL MEASUREMENTS:

Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L.

Hung. J. Ind. Chem. 1976, 4, 269-280.

VARIABLES:

T/K: 298.15 - 313.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

S. A. Johnson

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	2.51	0.383	0.418
313.15	1.94	0.290	0.333

The mole fraction solubilities and Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT\ \ln X_1 = -13{,}331 + 94.494\ T$

The above equation reproduces exactly the two solubility values, but it is not recommended. Comparisons of the author's data with the values of others for argon + octane and argon + decane systems indicates the 298.15 K solubility value is probably reliable, but that the 313.15 K solubility value may be up to 30 percent low.

See the evaluation sheet for this system for the recommended Gibbs energy equation and solubility values.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric method. The apparatus of Bodor, Bor, Mohai and Sipos (1) was used.

SOURCE AND PURITY OF MATERIALS:

Both the gas and liquid were analytical grade reagents of Hungarian or foreign origin. No further information.

DATA CLASS:

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$ at 298.15 K.

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G. *Veszpremi Vegyip. Egy. Kozl.* 1957, 1, 55. *Chem. Abstr.* 1961, 55, 3175h.

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. Octane; C_8H_{18}; 111-65-9	H. L. Clever Department of Chemistry Emory University Atlanta, Georgia 30322 U.S.A. January 1979

CRITICAL EVALUATION:

The solubility of argon in octane at 101.325 kPa (1 atm) was reported by four laboratories. Clever, Battino, Saylor and Gross (1) reported three values between 287.15 and 313.45 K. Makranczy, Megyery-Balog, Rusz and Patyi (2) reported two values at 298.15 and 313.15 K. Wilcock, Battino and Danforth (3) reported three values between 283.27 and 313.04 K. Graham and Weale (4) extrapolated three values between 323.15 and 373.15 K from their high pressure solubility measurements.

Only the 313.15 K value of Makranczy *et al.* departed from the Gibbs energy equation linear in temperature fitted to the data by the method of least squares. That value was omitted and the values of Clever *et al.*, the 298.15 value of Makranczy *et al.* and the values of Wilcock *et al.* were fitted by the method of least squares to the equation

$$\Delta G°/J\ mol^{-1} = - RT \ln X_1 = - 748.37 + 52.559\ T$$

$$\text{Std. Dev. } \Delta G° = 49.8, \quad \text{Coef. Corr.} = 0.9966$$

$$\Delta H°/J\ mol^{-1} = - 748.37, \quad \Delta S°/J\ K^{-1}\ mol^{-1} = -52.559$$

for the recommended changes in the thermodynamic properties for the transfer of one mole of argon at 101.325 kPa to the hypothetical unit mole fraction solution.

Table 1 gives the recommended mole fraction solubilities and Gibbs energy change at 101.325 kPa as a function of temperature.

TABLE 1. The solubility of argon in octane at 101.325 kPa. Recommended mole fraction solubility and Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction* $X_1 \times 10^3$	$\Delta G°/J\ mol^{-1}$
283.15	2.470	14,134
288.15	2.455	14,396
298.15	2.445	14,659
298.15	2.430	14,922
303.15	2.420	15,185
308.15	2.405	15,448
313.15	2.395	15,710
318.15	2.385	15,973

*Rounded to the nearest 0.005 x 10^{-3}

The recommended equation reproduces the Graham and Weale values by -1.3, -4.7, and -6.5 percent when extrapolated to 373.15 K.

When all four laboratories data are fitted to a Gibbs energy equation linear in temperature we obtain the equation

$$\Delta G°/J\ mol^{-1} = RT \ln X_1 = 244.10 + 49.231\ T$$

$$\text{Std. Dev. } \Delta G° = 56.8, \quad \text{Coef. Corr.} = 0.9992$$

Although the equation reproduces the solubility data fairly well, it is not recommended because it gives an endothermic enthalpy of solution change which is contrary to the sign of the enthalpy solution for other argon + aliphatic hydrocarbon solutions.

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. Octane; C_8H_{18}; 111-65-9	H. L. Clever Chemistry Department Emory University Atlanta, Georgia 30322 U.S.A.

CRITICAL EVALUATION:

Masterton, Robins, and Slowinksi (5) report an apparent molar volume of argon in octane of 48 ± 2 $cm^3\ mol^{-1}$ at 303.15 K and 10132.5 kPa (100 atm).

1. Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M. *J. Phys. Chem.* 1957, *61*, 1078.
2. Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L. *Hung. J. Ind. Chem.* 1976, *4*, 269.
3. Wilcock, R. J.; Battino, R.; Danforth, W. F. *J. Chem. Thermodyn.* 1978, *10*, 816.
4. Graham, E. B.; Weale, K. E. Progress in International Research on Thermodynamics and Transport Properties, Princeton, New Jersey 1962, pp.153-158.
5. Masterton, W. L.; Robins, D. A.; Slowinksi, E. J. *J. Chem. Eng. Data* 1961, *6*, 531.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Octane; C_8H_{18}; 111-65-9

ORIGINAL MEASUREMENTS:

Clever, H. L.; Battino, R.;
Saylor, J. H.; Gross, P. M.

J. Phys. Chem. 1957, *61*, 1078 - 1083.

VARIABLES:

T/K: 287.15 - 313.15
P/kPa: 101.325

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
287.15	2.44	0.338	0.335
298.15	2.45	0.336	0.367
313.45	2.41	0.324	0.372

The solubility values were adjusted to a partial pressure of argon of 101.325 kPa by Henry's law.

The Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -388.96 + 51.340\ T$

Std. Dev. $\Delta G°$ - 13.6, Coef. Corr. = 0.9998

For the recommended Gibbs energy equation and the smoothed values of mole fraction solubility see the evaluation of the solubility of argon in octane.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The solvent is saturated with the gas as it flows through an 8 mm x 180 cm glass helix attached to a gas buret. The total pressure of solute gas plus solvent vapor is maintained at 1 atm as the gas is absorbed.

The apparatus is a modification of that of Morrison and Billett (1). The modifications include the addition of a helical storage for the solvent, a manometer for a constant reference pressure, and an extra bure for use with highly soluble gases. The solvent is degassed by a modification of the method of Baldwin and Daniel (2).

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co. Both standard and research grades were used with no difference in results.
2. Octane. Humphrey-Wilkinson Co., Inc. Shaken with H_2SO_4, washed, dried over sodium, distilled.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/mmHg = 3$
$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Morrison, T.J.; Billett, F. *J. Chem. Soc.* 1948, 2033; *Ibid.* 1952, 3819.
2. Baldwin, R.R.; Daniel, S.G. *J. Appl. Chem.* 1952, *2*, 161.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Octane; C_8H_{18}; 111-65-9

ORIGINAL MEASUREMENTS:

Graham, E. B.; Weale, K. E.

Progr. Internat. Res. Thermodynamic and Transport Properties, Symposium on Thermophysical Properties, 2nd., Princeton, 1962, 153 - 158.

Chem. Abstr. 1962, 57, 1616i.

VARIABLES:

T/K: 323.15 - 373.15

PREPARED BY:

A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
323.15	2.4	0.32	0.38
348.15	2.5	0.32	0.41
373.15	2.5	0.35	0.48

The authors estimated the mole fraction solubility at 1 atm from their high pressure solubility values measured between pressure of 50 to 305 bar. See page 274 for the high pressure solubility values for the system.

The compiler calculated the Bunsen and Ostwald coefficients.

The high pressure data were fitted to an equation of the type $s = aP + bP^2$ to obtain the one atm values given above. The symbol s represents the mole ratio of argon to octane in the saturated solution. The authors converted the calculated value of s at one atmosphere argon pressure to the mole fraction values above.

AUXILIARY INFORMATION

METHOD:

See the high pressure solubility data sheet for details.

SOURCE AND PURITY OF MATERIALS:

APPARATUS/PROCEDURE:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Octane; C_8H_{18}; 111-65-9

ORIGINAL MEASUREMENTS:

Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L.

Hung. J. Ind. Chem. 1976, *4*, 269-280.

VARIABLES:

T/K: 298.15 - 313.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

S. A. Johnson

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	2.49	0.342	0.373
313.15	1.89	0.255	0.292

The mole fraction solubilities and Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -14{,}268 + 97.204\ T$

The above equation reproduces exactly the two solubility values, but it is not recommended. Comparisons of the author's data with the values of others for argon + octane and argon + decane systems indicates the 298.15 K solubility value is probably reliable, but that the 313.15 K solubility value may be up to 30 per cent low.

See the evaluation sheet for this system for the recommended Gibbs energy equation and solubility values.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric method. The apparatus of Bodor, Bor, Mohai, and Sipos (1) was used.

SOURCE AND PURITY OF MATERIALS:

Both the gas and liquid were analytical grade reagents of Hungarian or foreign origin. No further information.

DATA CLASS:

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$ at 298.15 K

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G. *Veszpremi Vegyip. Egy. Kozl.* 1957, *1*, 55. *Chem. Abstr.* 1961, *55*, 3175h.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Octane; C_8H_{18}; 111-65-9

ORIGINAL MEASUREMENTS:

Wilcock, W. J.; Battino, R.; Danforth, W. F.; Wilhelm, E.

J. Chem. Thermodyn. 1978, 10, 817 - 822.

VARIABLES:

T/K: 283.27 - 313.04
P/kPa: 101.325 (1 atm)

PREPARED BY:

A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
283.27	2.496	0.3487	0.3616
298.27	2.336	0.3207	0.3502
313.04	2.392	0.3228	0.3700

The Bunsen coefficients were calculated by the compiler.

A preliminary account of this work appeared in Conf. Int. Thermodyn. Chim. {C.R.}, 4th 1975, 6, 122 - 128.

Smoothed Data: $\Delta G^0/J\ mol^{-1} = -RT \ln X_1 = -1{,}023.4 + 53.568\ T$

Std. Dev. $\Delta G^0 = 62.6$, Coef. corr. = 0.9969

See the evaluation of the argon + octane system for the recommended Gibbs energy equation and the smoothed values of mole fraction solubility.

AUXILIARY INFORMATION

METHOD: The solubility apparatus is based on the design of Morrison and Billett (1), and the version used is described by Battino, Evans and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan and Wilhelm (3).

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to five microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus solvent vapor at a total ressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Either Matheson Co., Inc. or Air Products and Chemicals. Purest available commercial grade.
2. Octane. Phillips Petroleum Co. 99 mol per cent minimum.

ESTIMATED ERROR:

$\delta T/K = 0.02$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.01$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033.
2. Battino,R.;Evans,F.D.;Danforth,W.F. J.Am.Oil Chem.Soc. 1968, 45, 830.
3. Battino, R.;Banzhof, M.; Bogan, M.; Wilhelm, E. Anal. Chem. 1971, 43, 806.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 3-Methylheptane; C_8H_{18}; 589-81-1

ORIGINAL MEASUREMENTS:

Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M.

J. Phys. Chem. 1957, 61, 1078 - 1083.

VARIABLES:

T/K: 287.55 - 313.75
P/kPa: 101.325 (1 atm)

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
287.55	2.46	0.342	0.360
298.25	2.50	0.345	0.377
313.75	2.46	0.334	0.384

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -68.622 + 50.133\ T$

Std. Dev. $\Delta G°$ = 23.0, Coef. Corr. = 0.9994

$\Delta H°/J\ mol^{-1} = -68.622$, $\Delta S°/J\ K^{-1}\ mol^{-1} = -50.133$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/J\ mol^{-1}$
283.15	2.48	14,127
288.15	2.48	14,377
293.15	2.47	14,628
298.15	2.47	14,879
303.15	2.47	15,129
308.15	2.47	15,380
313.15	2.47	15,631
318.15	2.47	15,881

The solubility values were adjusted to a partial pressure of argon of 101.325 kPa (1 atm) by Henry's law.

The Bunsen coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD: Volumetric. The solvent is saturated with the gas as it flows through an 8 mm x 180 cm glass spiral attached to a gas buret. The total pressure of solute gas plus solvent vapor pressure is maintained at 1 atm as the gas is absorbed.

APPARATUS/PROCEDURE: The apparatus is a modification of that of Morrison and Billett (1). The modifications include the addition of a spiral storage for the solvent, a manometer for a constant reference pressure, and an extra buret for highly soluble gases. The solvent is degassed by a modification of the method of Baldwin and Daniel (2).

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Standard and research grades used.
2. 3-Methylheptane. Humphrey-Wilkinson, Inc. Shaken with H_2SO_4, washed, dried over Na, distilled through a vacuum column.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/torr = 3$
$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033; Ibid, 1952, 3819.

2. Baldwin, R. R.; Daniel, S. G. J. Appl. Chem. 1952, 2, 161.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 2,3-Dimethylhexane; C_8H_{18}; 584-94-1

ORIGINAL MEASUREMENTS:

Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M.

J. Phys. Chem. 1957, 61, 1078 - 1083.

VARIABLES:

T/K: 288.15 - 313.65
P/kPa: 101.325 (1 atm)

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Mole Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
288.15	2.56	0.361	0.381
297.95	2.48	0.346	0.377
313.65	2.42	0.331	0.380

Smoothed Data: $\Delta G°/J\ mol^{-1} = -1610.12 + 55.237\ T$

Std. Dev. $\Delta G° = 12.75$, Coef. Corr. = 0.9998

$\Delta H°/J\ mol^{-1} = 1610.12$, $\Delta S°/J\ K^{-1}\ mol^{-1} = -55.237$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/J\ mol^{-1}$
288.15	2.55	14,306
293.15	2.52	14,582
298.15	2.49	14,859
303.15	2.47	15,135
308.15	2.44	15,411
313.15	2.42	15,687
318.15	2.39	15,963

The solubility values were adjusted to a partial pressure of argon of 101.325 kPa (1 atm) by Henry's law.

The Bunsen coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD: Volumetric. The solvent is saturated with the gas as it flows through an 8 mm x 180 cm glass spiral attached to a gas buret. The total pressure of solute gas plus solvent vapor pressure is maintained at 1 atm as the gas is absorbed.

APPARATUS/PROCEDURE: The apparatus is a modification of that of Morrison and Billett (1). The modifications include the addition of a spiral storage for the solvent, a manometer for a constant reference pressure, and an extra buret for highly soluble gases. The solvent is degassed by a modification of the method of Baldwin and Daniel (2).

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Inc. Standatd and Research grades used.
2. 2,3-Dimethylhexane. Humphrey-Wilkinson, Inc. Shaken with H_2SO_4, washed, dried, over Na, distilled through a vacuum column.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/torr = 3$
$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Morrison, T. J.; Billet, F. J. Chem. Soc. 1948, 2033; Ibid, 1952, 3819.
2. Baldwin, R. R.; Daniel, S. G. J. Appl. Chem. 1952, 2, 161.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 2,4-Dimethylhexane; C_8H_{18}; 589-43-5

ORIGINAL MEASUREMENTS:

Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P.M.

J. Phys. Chem. 1957, 61, 1078 - 1083.

VARIABLES:

T/K: 288.15 - 313.55
P/kPa: 101.325 (1 atm)

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
288.15	2.73	0.379	0.400
298.15	2.67	0.366	0.400
313.15	2.62	0.353	0.405

Smoothed Data: $\Delta G°/J\ mol^{-1} = -1,190.8 + 53.23\ T$

Std. Dev. $\Delta G° = 7.4$, Coef. Corr. = 0.99994

$\Delta H°/J\ mol^{-1} = -1,190.8$, $\Delta S°/J\ K^{-1}\ mol^{-1} = -53.23$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/J\ mol^{-1}$
288.15	2.72	14,148
293.15	2.70	14,415
298.15	2.68	14,681
303.15	2.66	14,947
308.15	2.64	15,213
313.15	2.62	15,480
318.15	2.60	15,745

The solubility values were adjusted to a partial pressure of argon of 101.325 kPa (1 atm) by Henry's law.

The Bunsen coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD: Volumetric. The solvent is saturated with the gas as it flows through an 8 mm x 180 cm glass spiral attached to a gas buret. The total pressure of solute gas plus solvent vapor pressure is maintained at 1 atm as the gas is absorbed.

APPARATUS/PROCEDURE: The apparatus is a modification of that of Morrison and Billett (1). The modifications include the addition of a spiral storage for the solvent, a manometer for a constant reference pressure, and an extra buret for highly soluble gases. The solvent is degassed by a modification of the method of Baldwin and Daniel (2).

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., standard and research grades used.
2. 2,4-Dimethylhexane. Humphrey-Wilkinson, Inc. Shaken with H_2SO_4, washed, dried over Na, distilled through a vacuum column.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/torr = 3$
$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033; Ibid, 1952, 3819.
2. Baldwin, R. R.; Daniel, S. G. J. Appl. Chem. 1952, 2, 161.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 2,2,4-Trimethylpentane or Isooctane C_8H_{18}; 540-84-1

EVALUATOR:

H. L. Clever
Chemistry Department
Emory University
Atlanta, GA 30322
U.S.A.

June 1979

CRITICAL EVALUATION:

The solubility of argon in 2,2,4-trimethylpentane was measured at an argon partial pressure of 101.325 kPa (1 atm) at three temperatures between 288.15 and 313.65 K by Clever, Battino, Saylor, and Gross (1) and at pressures of 5.07 x 10^3 to 25.33 x 10^3 kPa (50 to 250 atm) at temperatures of 323.15, 348.15, and 373.15 K by Graham and Weale (2) (see p. 275).

Graham and Weale extrapolated their data to 101.325 kPa (1 atm) by use of an equation of the type $S = aP + bP^2$ where S is the mole ratio composition of the liquid phase. Below are summarized the mole fraction solubilities of argon at a partial pressure of 101.325 kPa extrapolated from the high pressure data of Graham and Weale and extrapolated from the data of Clever, *et al.*, of lower temperatures and atmospheric pressure.

T/K	Mol Fraction/X_1 x 10^3	
	Graham & Weale	Clever *et al.*
323.15	2.7	2.7
348.15	2.8	2.6
373.15	2.6	2.4

Considering the nature of the extrapolation the agreement is satisfactory and gives confidence in the reliability of both sets of data.

Tentative values of the changes in thermodynamic properties for the transfer of one mole of argon from the gas at 101.325 kPa to the hypothetical unit mole fraction solution are based on the data of Clever *et al.* The values are

$$\Delta G°/\text{J mol}^{-1} = -RT \ln X_1 = -2201.9 + 55.904\ T$$

$$\text{Std. Dev. } \Delta G° = 8.0, \quad \text{Coef. Corr.} = 0.9999$$

$$\Delta H°/\text{J mol}^{-1} = -2201.9, \quad \Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -55.904$$

A table of tentative mole fraction solubility values at an argon partial pressure of 101.325 kPa and the Gibbs energy of solution as a function of temperature are given on the data sheet on the following page.

There are two reports of the partial molal volume of argon in 2,2,4-trimethyl pentane at 298.15 K. Both measurements were by dilatometry at 101.325 kPa pressure. Jolley and Hildebrand (3) report a value of 50 ± 1 cm^3 mol^{-1} and Walkley and Jenkins (4) report a value of 49.6 ± 0.5 cm^3 mol^{-1}.

1. Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M. *J. Phys. Chem.* 1957, *61*, 1078.
2. Graham E. B.; Weale, K. E. in *Progress in International Research on Thermodynamics and Transport Properties*, Princeton University (Masi, J. F.; Tsai, D. H., Editors) Academic Press, New York, 1962, p. 153.
3. Jolley, J. E.; Hildebrand, J. H. *J. Am. Chem. Soc.* 1958, *80*, 1050.
4. Walkley, J.; Jenkins, W. I. *Trans. Faraday Soc.* 1968, *64*, 19.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 2,2,4-Trimethylpentane or Iso-octane; C_8H_{18}; 540-84-1

ORIGINAL MEASUREMENTS:

Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M.

J. Phys. Chem. 1957, 61, 1078 - 1083.

VARIABLES:

T/K: 288.15 - 313.65
P/kPa: 101.325 (1 atm)

PREPARED BY:

P. L. Long
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
288.15	3.02	0.413	0.436
298.15	2.91	0.395	0.431
313.65	2.80	0.371	0.426

The Bunsen coefficients were calculated by the compiler.
The solubility values were adjusted to an argon partial pressure of 101.325 kPa (1 atm) by Henry's law.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -2201.9 + 55.904\ T$

Std. Dev. $\Delta G°$ = 8.0, Coef. Corr. = 0.9999

$\Delta H°/J\ mol^{-1} = -2201.9$, $\Delta S°/J\ K^{-1}\ mol^{-1} = -55.904$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/J\ mol^{-1}$
288.15	3.01	13,907
293.15	2.97	14,186
298.15	2.92	14,466
303.15	2.88	14,745
308.15	2.84	15,025
313.15	2.80	15,305
318.15	2.76	15,584

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solvent is saturated with the gas as it flows through an 8 mm x 180 cm glass helix attached to a gas buret. The total pressure of solute gas plus solvent vapor is maintained at 1 atm as the gas is absorbed.

The apparatus is a modification of that of Morrison and Billett (1). The modifications include the addition of a helical storage for the solvent, a manometer for a constant reference pressure, and an extra buret for use with highly soluble gases. The solvent is degassed by a modification of the method of Baldwin and Daniel (2).

SOURCE AND PURITY OF MATERIALS:

1. Argon. Both Matheson Co., Inc. Standard and research grades used with no difference in results.
2. 2,2,4-Trimethylpentane. Enjay Co. Used as received.

DATA CLASS:

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/mmHg = 3$
$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033; ibid. 1952, 3819.
2. Baldwin, R. R.; Daniel, S. G. J. Appl. Chem. 1952, 2, 161.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Nonane; C_9H_{20}; 111-84-2

EVALUATOR:

H. L. Clever
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U.S.A.

CRITICAL EVALUATION:

The solubility of argon in nonane at 101.325 kPa was determined in two laboratories. Clever, Battino, Saylor, and Gross (1) reported three values between 288.35 and 313.50 K. Makranczy, Megyery-Balog, Rusz and Patyi (2) report values at 298.15 and 313.15 K.

The Makranczy *et al.* solubility at 298.15 K agrees exactly, but the solubility at 313.15 K is 22.0 per cent below the smoothed values of Clever *et al.* The Makranczy *et al.* 313.15 K solubility value for argon dissolved in aliphatic hydrocarbons appears to be consistently 20-30 percent lower than results from other laboratories. One suspects a systematic error, which if it could be found and corrected, might bring the value into line with the other's values.

The Clever, *et al.* solubility data and the 298.15 K Makranczy *et al.* were combined in a Gibbs energy equation linear in temperature by the method of least squares.

The tentative thermodynamic values for the transfer of one mole of argon from the gas at 101.325 kPa (1 atm) to the hypothetical unit mole fraction solution are

$$\Delta G°/\mathrm{J\ mol^{-1}} = -RT \ln X_1 = -1{,}560.5 + 55.107\ T$$

$$\text{Std. Dev. } \Delta G° = 24.7, \quad \text{Coef. Corr.} = 0.9991$$

$$\Delta H°/\mathrm{J\ mol^{-1}} = -1{,}560.5, \quad \Delta S°/\mathrm{J\ K^{-1}\ mol^{-1}} = -55.107$$

The tentative values of the mole fraction solubility at 101.325 kPa and the Gibbs energy of solution are given as a function of temperature in Table 1.

TABLE 1. Solubility of argon in nonane at 101.325 kPa. Tentative mole fraction solubility and Gibbs energy of solution as a function temperature.

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/\mathrm{J\ mol^{-1}}$
288.15	2.54	14,319
293.15	2.51	14,594
298.15	2.48	14,870
303.15	2.46	15,145
308.15	2.43	15,421
313.15	2.41	15,696
318.15	2.39	15,972

1. Clever. H. L.; Battino, R.; Saylor, J. H.; Gross, P. M. *J. Phys. Chem.* 1957, *61*, 1078.
2. Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L. *Hung. J. Ind. Chem.* 1976, *4*, 269.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Nonane; C_9H_{20}; 111-84-2

ORIGINAL MEASUREMENTS:

Clever, H. L.; Battino, R.;
Saylor, J. H.; Gross, P. M.

J. Phys. Chem. 1957, 61, 1078 - 1083.

VARIABLES:

T/K: 288.35 - 313.50
P/kPa: 101.325

PREPARED BY:

P. L. Long
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
288.35	2.56	0.322	0.340
297.95	2.45	0.310	0.338
313.50	2.42	0.298	0.342

The solubility values were adjusted to a partial pressure of argon of 101.325 kPa by Henry's law.

The Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = - RT \ln X_1 = -1565.5 + 55.121\ T$

Std. Dev. $\Delta G°$ = 30.2, Coef. Corr. = 0.9991

For the recommended Gibbs energy equation and the smoothed values of mole fraction solubility see the evaluation of the solubility of argon in nonane.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solvent is saturated with the gas as it flows through an 8 mm x 180 cm glass helix attached to a gas buret. The total pressure of solute gas plus solvent vapor is maintained at 1 atm as the gas is absorbed.

The apparatus is a modification of that of Morrison and Billett (1) The modifications include the addition of a helical storage for the solvent, a manometer for a constant reference pressure, and an extra buret for use with highly soluble gases. The solvent is degassed by a modification of the method of Baldwin and Daniel (2).

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co. Both standard and research grades were used with no difference in results.
2. Nonane. Phillips Petroleum Co. Pure grade, used as received.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/mmHg = 3$
$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033; ibid. 1952, 3819.
2. Baldwin, R. R.; Daniel, S. G. J. Appl. Chem. 1952, 2, 161.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Nonane; C_9H_{20}; 111-84-2

ORIGINAL MEASUREMENTS:

Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L.

Hung. J. Ind. Chem. 1976, *4*, 269-280.

VARIABLES:

T/K: 298.15 - 313.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

S. A. Johnson

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	2.48	0.310	0.338
313.15	1.88	0.231	0.265

The mole fraction solubilities and Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -14{,}334 + 97.960\ T$

The above equation reproduces exactly the two solubility values, but it is not recommended. Comparisons of the author's data with the values of others for argon + octane and argon + decane systems indicates the 298.15 K solubility value is probably reliable, but that the 313.15 K solubility value may be up to 30 per cent low.

See the evaluation sheet for this system for the recommended Gibbs energy equation and solubility values.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric method. The apparatus of Bodor, Bor, Mohai, and Sipos (1) was used.

SOURCE AND PURITY OF MATERIALS:

Both the gas and liquid were analytical grade reagents of Hungarian or foreign origin. No further information.

DATA CLASS:

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$ at 298.15 K.

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
Veszpremi Vegyip. Egy. Kozl. 1957, *1*, 55.
Chem. Abstr. 1961, *55*, 3175h.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Decane; $C_{10}H_{22}$; 124-18-5

EVALUATOR:

H. L. Clever
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U.S.A.

CRITICAL EVALUATION:

The solubility of argon in decane at 101.325 kPa was measured at three laboratories. Clever, Battino, Saylor, and Gross (1) reported three values between 287.25 and 313.50 K. Makranczy, Megyery-Balog, Rusz, and Patyi (2) reported values at 298.15 and 313.15 K. Wilcock, Battino, and Danforth (3) reported three values between 283.20 and 313.54 K.

The Clever *et al.* and the Wilcock *et al.* solubility data accord within 1.2-1.6 percent over the 283.15 - 313.15 K temperature interval. The Makranczy *et al.* value at 298.15 K is 2.4 percent lower and the 313.15 K value is 26.0 percent lower than the values from the other laboratories. The Makranczy *et al.* 313.15 K value for argon dissolved in hydrocarbons appears to be consistently low by 20-30 percent. One suspects a systematic error, which if corrected might bring the value into line with the value of others.

Wilcock *et al.* use an improved degassing technique and apparatus. Their data should be the most reliable. However, for the recommended values we have combined the 298.15 K solubility value of Makranczy *et al.*, the data of Clever *et al.*, and the data of Wilcock *et al.* on a one to one weight basis.

The recommended thermodynamic values for the transfer of one mole of argon from the gas at 101.325 kPa (1 atm) to the hypothetical unit mole fraction solution are

$$\Delta G°/\text{J mol}^{-1} = -RT \ln X_1 = -1{,}501.1 + 54.925\,T$$

$$\text{Std. Dev. } \Delta G° = 29.8, \quad \text{Coef. Corr.} = 0.9989$$

$$\Delta H°/\text{J mol}^{-1} = -1{,}501.1, \quad \Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -54.925$$

The recommended values of the mole fraction solubility at 101.325 kPa and the Gibbs energy of solution are given as a function of temperature in Table 1.

TABLE 1. Solubility of argon in decane at 101.325 kPa. Mole fraction solubility and Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction* $X_1 \times 10^3$	$\Delta G°/\text{J mol}^{-1}$
283.15	2.56	14,051
288.15	2.53	14,325
293.15	2.505	14,600
298.15	2.48	14,875
303.15	2.455	15,149
308.15	2.43	15,423
313.15	2.405	15,699
318.15	2.385	15,973

* To the nearest 0.005×10^{-3}

1. Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M. J. Phys. Chem. 1957, 61, 1078.
2. Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L. Hung. J. Ind. Chem. 1976, 4, 269.
3. Wilcock, R. J.; Battino, R.; Danforth, W. F. J. Chem. Thermodyn. 1978,

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Decane; $C_{10}H_{22}$; 124-18-5

ORIGINAL MEASUREMENTS:

Clever, H. L.; Battino, R.;
Saylor, J. H.; Gross, P. M.

J. Phys. Chem. 1957, *61*, 1078 - 1083.

VARIABLES:

T/K: 287.25 - 313.50
P/kPa: 101.325

PREPARED BY:

P. L. Long
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
287.25	2.57	0.300	0.315
298.15	2.48	0.285	0.311
313.50	2.44	0.276	0.317

The solubility values were adjusted to a partial pressure of argon of 101.325 kPa by Henry's law.

The Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/\text{J mol}^{-1} = - RT \ln X_1 = -1428.7 + 54.602\ T$

Std. Dev. $\Delta G° = 18.5$, Coef. Corr. = 0.9997

For the recommended Gibbs energy equation and the smoothed values of mole fraction solubility see the evaluation of the solubility of argon in decane.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The solvent is saturated with the gas as it flows through an 8 mm x 180 cm glass helix attached to a gas buret. The total pressure of solute gas plus solvent vapor is maintained at 1 atm as the gas is absorbed.

The apparatus is a modification of that of Morrison and Billett (2). The modifications include the addition of a helical storage for the solvent, a manometer for a constant reference pressure, and an extra buret for use with highly soluble gases. The solvent is degassed by a modification of the method of Baldwin and Daniel (2).

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co. Both standard and research grades were used with no difference in results.
2. Decane. Humphrey-Wilkinson Co., Inc. Shaken with H_2SO_4, washed, dried over sodium, distilled.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/\text{mmHg} = 3$
$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033; *ibid.* 1952, 3819.
2. Baldwin, R. R.; Daniel, S. G. *J. Appl. Chem.* 1952, *2*, 161.

COMPONENTS:

1. Argon; AR; 7440-37-1
2. Decane; $C_{10}H_{22}$; 124-18-5

ORIGINAL MEASUREMENTS:

Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L.

Hung. J. Ind. Chem. 1976, 4, 269-280.

VARIABLES:

T/K: 298.15 - 313.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

S. A. Johnson

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	2.44	0.279	0.305
313.15	1.79	0.201	0.231

The mole fraction solubilities and Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -16{,}032 + 103.79\ T$

The above equation reproduces exactly the two solubility values, but it is not recommended. Comparisons of the author's data with the values of others for argon + octane and argon + decane systems indicates the 298.15 K solubility value is probably reliable, but that the 313.15 K solubility value may be up to 30 per cent low.

See the evaluation sheet for this system for the recommended Gibbs energy equation and solubiliby values.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric method. The apparatus of Bodor, Bor, Mohai, and Sipos (1) was used.

SOURCE AND PURITY OF MATERIALS:

Both the gas and liquid were analytical grade reagents of Hungarian or foreign origin. No further information.

DATA CLASS:

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$ at 298.15 K

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
Veszpremi Vegyip. Egy. Kozl. 1957, 1, 55.
Chem. Abstr. 1961, 55, 3175h.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Decane; $C_{10}H_{22}$; 124-18-5

ORIGINAL MEASUREMENTS:

Wilcock, R. J.; Battino, R.; Danforth, W. F.; Wilhelm, E.

J. Chem. Thermodyn. 1978, 10, 817-822.

VARIABLES:

T/K: 283.20 - 313.54
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
283.20	2.567	0.2988	0.3098
298.05	2.442	0.2800	0.3055
313.54	2.399	0.2706	0.3106

The Bunsen coefficients were calculated by the compiler.

The solubility values were adjusted to 101.325 kPa (1 atm) assuming Henry's law.

Smoothed Data: $\Delta G^o/J\ mol^{-1} = -RT \ln X_1 = -1637.3 + 55.421\ T$

Std. Dev. $\Delta G^o = 7.9$, Coef. Corr. = 0.9999

$\Delta H^o/J\ mol^{-1} = -1637.3$, $\Delta S^o/J\ K^{-1}\ mol^{-1} = -55.421$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^o/J\ mol^{-1}$
278.15	2.59	13,778
288.15	2.52	14,332
298.15	2.47	14,886
308.15	2.41	15,441
318.15	2.37	15,995

See the evaluation of the argon + decane system on page 128 for the recommended free energy equation and a smoothed solubility values.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Inc. 99.995 per cent.
2. Decane. Phillips Petroleum Co. 99 mol % distilled, density, $\rho_{298.15} = 0.7264$.

ESTIMATED ERROR:

$\delta T/K = 0.02$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.01$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. J. Am. Oil Chem. Soc. 1968, 45, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. Anal. Chem. 1971, 43, 806.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Undecane; $C_{11}H_{24}$; 1120-21-4

ORIGINAL MEASUREMENTS:

Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L.

Hung. J. Ind. Chem. 1976, *4*, 269-280.

VARIABLES:

T/K: 298.15 - 313.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

S. A. Johnson

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	2.56	0.271	0.296
313.15	1.79	0.187	0.214

The mole fraction solubilities and the Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -18,516 + 111.22\ T$

The above equation reproduces exactly the two solubility values, but it is not recommended. Comparisons of the author's data with the values of others for argon + octane and argon + decane systems indicates the 298.15 K solubility value is probably reliable, but that the 313.15 K solubility value may be up to 30 per cent low.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Volumetric method. The apparatus of Bodor, Bor, Mohai, and Sipos (1) was used.

SOURCE AND PURITY OF MATERIALS:

Both the gas and liquid were analytical grade reagents of Hungarian or foreign origin. No further information.

DATA CLASS:

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$ at 298.15 K

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
Veszpremi Vegyip. Egy. Kozl. 1957, *1*, 55.
Chem. Abstr. 1961, *55*, 3175h.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Dodecane; $C_{12}H_{26}$; 112-40-3

EVALUATOR:

H. L. Clever
Chemistry Department
Emory University
Atlanta, Georgia 30322
U.S.A.

CRITICAL EVALUATION:

The solubility of argon in dodecane was reported by two laboratories. Clever, Battino, Saylor, and Gross (1) reported three values between 287.45 and 313.65 K. Makranczy, Megyery-Balog, Rusz and Patyi (2) reported values at 298.15 and 313.15 K.

The Makranczy *et al*. value at 298.15 K is 4.7 percent lower, and the value at 313.15 K is 30.3 per cent lower than the Clever *et al*. solubility values. The 313.15 K Makranczy *et al*. value appears to be low for all of the argon in hydrocarbon solubility values. See the argon + octane and argon + decane evaluation sheets for further evidence.

The Clever *et al*. data for argon in dodecane is internally self-consistent. They are used for the tentative values of the thermodynamic functions and the mole fraction solubility values.

The tentative thermodynamic values for the transfer of one mole of argon from the gas at 101.325 kPa (1 atm) to the hypothetical unit mole fraction solution are

$$\Delta G°/\text{J mol}^{-1} = -RT \ln X_1 = -510.32 + 51.301\ T$$

$$\text{Std. Dev. } \Delta G° = 15.7, \quad \text{Coef. Corr.} = 0.9997$$

$$\Delta H°/\text{J mol}^{-1} = -510.32, \quad \Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -51.301$$

The tentative values of the mole fraction solubility at 101.325 kPa and the Gibbs energy of solution are given as a function of temperature in Table 1.

TABLE 1. Solubility of argon in n-dodecane at 101.325 kPa. Tentative mole fraction solubility and Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/\text{J mol}^{-1}$
283.15	2.60	14,016
288.15	2.59	14,272
293.15	2.58	14,529
298.15	2.57	14,785
303.15	2.56	15,042
308.15	2.55	15,298
313.15	2.54	15,555
318.15	2.54	15,811

1. Clever. H. L.; Battino, R.; Saylor, J. H.; Gross, P. M. *J. Phys. Chem.* 1957, *61*, 1078.

2. Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L. *Hung. J. Ind. Chem.* 1976, *4*, 269.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Dodecane; $C_{12}H_{26}$; 112-40-3

ORIGINAL MEASUREMENTS:

Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M.

J. Phys. Chem. 1957, *61*, 1078 - 1083.

VARIABLES:

T/K: 287.45 - 313.65
P/kPa: 101.325

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
287.45	2.60	0.258	0.271
298.25	2.55	0.252	0.275
313.65	2.55	0.246	0.282

The solubility values were adjusted to a partial pressure of argon of 101.325 kPa by Henry's law.

The Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -510.3 + 51.3\ T$

Std. Dev. $\Delta G°$ = 15.7, Coef. Corr. = 0.9997

For the recommended Gibbs energy equation and the smoothed values of mole fraction solubility see the evaluation of the solubility of argon in dodecane.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The solvent is saturated with the gas as it flows through an 8 mm x 180 cm glass helix attached to a gas buret. The total pressure of solute gas plus solvent vapor is maintained at 1 atm as the gas is absorbed.

The apparatus is a modification of that of Morrison and Billett (1). The modifications include the addition of a helical storage for the solvent, a manometer ofr a constant reference pressure, and an extra buret for use with highly soluble gases. The solvent is degassed by a modification of the method of Baldwin and Daniel (2).

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co. Both standard and research grades were used with no difference in results.
2. Dodecane. Humphrey-Wilkinson Co., Inc. Shaken with H_2SO_4, washed, dried over sodium.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/mmHg = 3$
$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033; *Ibid.* 1952, 3819.
2. Baldwin. R. R.; Daniel, S. G. *J. Appl. Chem.* 1952, *2*, 161.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Dodecane; $C_{12}H_{26}$; 112-40-3

ORIGINAL MEASUREMENTS:

Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L.

Hung. J. Ind. Chem. 1976, 4, 269-280.

VARIABLES:

T/K: 298.15 - 313.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

S. A. Johnson

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	2.45	0.241	0.263
313.15	1.77	0.171	0.196

The mole fraction solubilities and Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -\ RT\ ln\ X_1 = -16{,}825 + 106.41\ T$

The above equation reproduces exactly the two solubility values, but it is not recommended. Comparisons of the author's data with the values of others for argon + octane and argon + decane systems indicates the 298.15 K solubility value is probably reliable, but that the 313.15 K solubility value may be up to 30 per cent low.

See the evaluation sheet for this system for the recommended Gibbs energy equation and solubility values.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric method. The apparatus of Bodor, Bor, Mohai, and Sipos (1) was used.

SOURCE AND PURITY OF MATERIALS:

Both the gas and liquid were analytical grade reagents of Hungarian or foreign origin. No further information.

DATA CLASS:

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$ at 298.15 K.

REFERENCES:

1. Bodor, E.; Bor, By.; Mohai, B.; Sipos, G.
   Veszpremi Vegyip. Egy. Kozl. 1957, 1, 55.
   Chem. Abstr. 1961, 55, 3175h.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Tridecane; $C_{13}H_{28}$; 629-50-5

ORIGINAL MEASUREMENTS:

Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L.

Hung. J. Ind. Chem. 1976, 4, 269-280.

VARIABLES:

T/K: 298.15 - 313.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

S. A. Johnson

EXPERIMENTAL VALUES:

T/K:	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	2.47	0.226	0.247
313.15	1.75	0.158	0.181

The mole fraction solubilities and the Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = - RT \ln X_1 = - 17,834 + 109.73\ T$

The above equation reproduces exactly the two solubiliby values, but it is not recommended. Comparisons of the author's data with the values of others for argon + octane and argon + decane systems indicates the 298.15 K solubility value is probably reliable, but that the 313.15 K solubility value may be up to 30 per cent low.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric method. The apparatus of Bodor, Bor, Mohai, and Sipos (1) was used.

SOURCE AND PURITY OF MATERIALS:

Both the gas and liquid were analytical grade reagents of Hungarian or foreign orogin. No further information.

DATA CLASS:

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$ at 298.15 K.

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
Veszpremi Vegyip. Egy. Kozl. 1957, 1, 55.
Chem. Abstr. 1961, 55, 3175h.

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. Tetradecane; $C_{14}H_{30}$; 629-59-4	H. L. Clever Chemistry Department Emory University Atlanta, Georgia 30322 U.S.A.

CRITICAL EVALUATION:

The solubility of argon in tetradecane was reported by two laboratories. Clever, Battino, Saylor and Gross (1) reported three values between 287.45 and 313.45 K. Makranczy, Megyery-Balog, Rusz, and Patyi (2) reported values at 298.15 and 313.15 K.

The Makranczy *et al.* value at 298.15 is 5.4 percent lower and the value at 313.15 K is 30.4 percent lower than the Clever *et al.* solubility values. The 313.15 K Makranczy *et al.* value appears to be low for all the argon in hydrocarbon solubility values.

The Clever *et al.* data for argon in tetradecane is internally self-consistent. They have been used for the tentative values of the thermodynamic functions and the mole fraction solubility values.

The tentative thermodynamic values for the transfer of one mole of argon from the gas at 101.325 kPa (1 atm) to the hypothetical unit mole fraction solution are

$$\Delta G°/\text{J mol}^{-1} = -RT \ln X_1 = -1{,}689.1 + 55.198\ T$$

$$\text{Std. Dev. } \Delta G° = 3.6, \quad \text{Coef. Corr.} = 0.9999$$

$$\Delta H°/\text{J mol}^{-1} = -1{,}689.1, \quad \Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -55.198$$

The tentative values of the mole fraction solubility at 101.325 kPa and the Gibbs energy of solution are given as a function of temperatures in Table 1.

TABLE 1. Solubility of argon in tetradecane at 101.325 kPa. Tentative mole fraction solubility and Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°$/J mol^{-1}
283.15	2.68	13,940
288.15	2.65	14,216
293.15	2.62	14,493
298.15	2.59	14,768
303.15	2.56	15,044
308.15	2.53	15,320
313.15	2.50	15,596
318.15	2.48	15,872

1. Clever. H. L.; Battino, R.; Saylor, J. H.; Gross, P. M. *J. Phys. Chem.*, 1957, *61*, 1078.
2. Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L. *Hung. J. Ind. Chem.* 1976, *4*, 269.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Tetradecane; $C_{14}H_{30}$; 629-59-4

ORIGINAL MEASUREMENTS:

Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M.

J. Phys. Chem. 1957, *61*, 1078-1083.

VARIABLES:

T/K: 287.45 - 313.45
P/kPa: 101.325

PREPARED BY:

P. L. Long
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
287.45	2.65	0.235	0.247
298.25	2.59	0.229	0.250
313.45	2.50	0.218	0.250

The solubility values were adjusted to a partial pressure of argon of 101.325 kPa by Henry's law.

The Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/\text{J mol}^{-1} = -RT \ln X_1 = -1689.1 + 55.198\,T$

Std. Dev. $\Delta G° = 3.6$, Coef. Corr. = 0.99999

For the recommended Gibbs energy equation and the smoothed values of mole fraction solubility see the evaluation of the solubility of argon in tetradecane.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solvent is saturated with the gas as it flows through an 8 mm x 180 cm glass helix attached to a gas buret. The total pressure of solute gas plus solvent vapor is maintained at 1 atm as the gas is absorbed.

The apparatus is a modification of that of Morrison and Billett (1). The modifications include the addition of a helical storage for the solvent, a manometer for a constant reference pressure, and an extra buret for use with highly soluble gases. The solvent is degassed by a modification of the method of Baldwin and Daniel (2).

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co. Both standard and research grades were used with no difference in results.

2. Tetradecane. Humphrey-Wilkinson Co., Inc. Shaken with H_2SO_4, washed, dried over sodium

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/\text{mmHg} = 3$
$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033; *Ibid.* 1952, 3819.

2. Baldwin, R. R.; Daniel, S. G. *J. Appl. Chem.* 1952, *2*, 161.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Tetradecane; $C_{14}H_{30}$; 629-59-4

ORIGINAL MEASUREMENTS:

Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L.

Hung. J. Ind. Chem. 1976, 4, 269-280.

VARIABLES:

T/K: 298.15 - 313.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

S. A. Johnson

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	2.45	0.211	0.230
313.15	1.74	0.147	0.169

The mole fraction solubilities and Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -\ RT \ln X_1 = -17{,}709 + 109.38\ T$

The above equation reproduces exactly the two solubility values, but it is not recommended. Comparisons of the author's data with the values of others for argon + octane and argon + decane systems indicates the 298.15 K solubility value is probably reliable, but that the 313.15 K solubility value may be up to 30 per cent low.

See the evaluation sheet for this system for the recommended Gibbs energy equation and solubility values.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric method. The apparatus of Bodor, Bor, Mohai, and Sipos (1) was used.

SOURCE AND PURITY OF MATERIALS:

Both the gas and liquid were analytical grade reagents of Hungarian or foregin origin. No further information.

DATA CLASS:

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$ at 298.15 K

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
Veszpremi Vegyip. Egy. Kozl. 1957, 1, 55.
Chem. Abstr. 1961, 55, 3175h.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Pentadecane; $C_{15}H_{32}$; 629-62-9

ORIGINAL MEASUREMENTS:

Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L.

Hung. J. Ind. Chem. 1976, 4, 269-280.

VARIABLES:

T/K: 298.15 - 313.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

S. A. Johnson

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	2.47	0.200	0.218
313.15	1.75	0.140	0.160

The mole fraction solubilities and the Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -17{,}834 + 109.73\ T$

The above equation reproduces exactly the two solubility values, but it is not recommended. Comparisons of the author's data with the values of others for argon + octane and argon + decane systems indicates the 298.15 K solubility value is probably reliable, but that the 313.15 K solubility value may be up to 30 per cent low.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Volumetric method. The apparatus of Bodor, Bor, Mohai, and Sipos (1) was used.

SOURCE AND PURITY OF MATERIALS:

Both the gas and liquid were analytical grade reagents of Hungarian or foreign origin. No further information.

DATA CLASS:

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$ at 298.15 K

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
Veszpremi Vegyip. Egy. Kozl. 1957, 1, 55.
Chem. Abstr. 1961, 55, 3175h.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Hexadecane; $C_{16}H_{34}$; 544-76-3

ORIGINAL MEASUREMENTS:

Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L.

Hung. J. Ind. Chem. 1976, 4, 269-280.

VARIABLES:

T/K: 298.15 - 313.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

S. A. Johnson

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	2.47	0.189	0.206
313.15	1.66	0.125	0.143

The mole fraction solubilities and the Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -\ Rt\ \ln X_1 = -\ 20{,}566 + 118.89\ T$

The above equation reproduces exactly the two solubility values, but it is not recommended. Comparisons of the author's data with the values of others for argon + octane and argon + decane systems indicates the 298.15 K solubility value is probably reliable, but that the 313.15 K solubility value may be up to 30 per cent low.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Volumetric method. The apparatus of Bodor, Bor, Mohai, and Sipos (1) was used.

SOURCE AND PURITY OF MATERIALS:

Both the gas and liquid were analytical grade reagents of Hungarian or foreign origin. No further information.

DATA CLASS:

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$ at 298.15 K

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
Veszpremi Vegyip. Egy. Kozl. 1957, 1, 55.
Chem. Abstr. 1961, 55, 3175h.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Amsco 123-15

ORIGINAL MEASUREMENTS:

Steinberg, M.; Manowitz, B.

Ind. Eng. Chem. 1959, *51*, 47 - 51.

VARIABLES:

T/K: 218.15 - 297.15

P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Absorption Coefficient* β
218.15	0.42
297.15	0.29

* The authors define the absroption coefficient as the volume of gas, corrected to 288.15 K and 101.325 kPa (1 atm), absorbed under a total system pressure of 101.325 kPa per unit volume of solvent, corrected to 288.15 K. The authors incorrectly identify their absorption coefficient as an Ostwald coefficient.

AUXILIARY INFORMATION

METHOD:

Van Slyke method (1).

APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

1. Argon. No information given.
2. Amsco 123-15. American Mineral Spirits Solvent Co., No. 140. The composition is stated to be 59.6 wt % paraffin, 27.2 wt % naphthene, and 13.2 wt % aromatics.

ESTIMATED ERROR:

$\delta\beta/\beta = 0.10$

REFERENCES:

1. Van Slyke, D. D.
   J. Biol. Chem. 1939, *130*, 545.

   Van Slyke, D. D.; Neill, J. M.
   J. Biol. Chem. 1924, *61*, 523.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Paraffin oil

ORIGINAL MEASUREMENTS:

Nasini, A. G.; Corinaldi, G.

Soc. Ital. Prog. Sci. Atti Riun. 1932, 20, 264 - 266.

VARIABLES:

T/K: 305.15

P/kPa: 101.325 (1 atm)

PREPARED BY:

A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Bunsen Coefficient α	Ostwald Coefficient L
305.15	0.1575	0.1760

The Ostwald coefficient was calculated by the compiler.

AUXILIARY INFORMATION

METHOD:

The apparatus and procedure were based on those of Lannung (1).

APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

1. Argon. Source not given. Hydrogen and nitrogen impurities removed by heating with metallic calcium at 1130 K.
2. Paraffin oil. Density, $\rho_{288.15}$ = 0.87 g cm^{-3}.

ESTIMATED ERROR:

$\delta T/K = 0.1$

REFERENCES:

1. Lannung, A. J. Am. Chem. Soc. 1930, 52, 68.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Argon; Ar; 7440-37-1 2. Paraffin wax	Ridenour, W. P.; Weatherford, W. D.; Capell, R. G. Ind. Eng. Chem. 1954, 46, 2376-2381.
VARIABLES:	PREPARED BY:
T/K:345.35 P/kPa: 38.84 - 102.22 (291.7 - 766.7 mmHg)	A. L. Cramer H. L. Clever

EXPERIMENTAL VALUES:

T/K	Pressure/ mmHg	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Solubility Coefficient cm^3 Ar (STP) g^{-1} wax
345.35	291.7	1.24	0.157	0.079
	504.0	2.14	0.160	0.137
	766.7	3.33	0.161	0.211

AUXILIARY INFORMATION

METHOD:

The apparatus was similar to the equilibrium adsorption apparatus described by Brunauer, Emmett, and Teller (1) for the measurement of the surface area of a solid catalyst.

A weighed amount of wax was placed in the apparatus. The gas and solvent were equilibrated for 20 to 60 minutes. The gas volume in the buret system was calculated from the ideal gas law.

The results of the absorption measurments were checked by a desorption measurement. The two measurements agreed very well.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Ohio Chemical Co. The gas was 99.8 per cent Ar and 0.2 per cent N_2.
2. Paraffin wax. Described as "122 ^oF English melting point wax. Molecular weight 350, actual melt point 123.2 ^oF (323.8 K), density 0.7716 g cm^{-3} at 293.3 K and 0.7662 g cm^{-3} at 298.0 K.

ESTIMATED ERROR:

$\delta T/K = 2.$

$\delta P/mmHg = 0.2$

$\delta\alpha/cm^3 = 0.004$ (low pressure) - 0.001 (high pres.)

REFERENCES:

1. Brunaur, S.; Emmett, P. H.; Teller, E.
J. Am. Chem. Soc. 1938, 60, 309.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Cyclohexane; C_6H_{12}; 110-82-7

EVALUATOR:

H. L. Clever
Department of Chemistry
Emory University
Atlanta, GA 30322
USA

June 1979

CRITICAL EVALUATION:

Three laboratories have reported on the solubility of argon in cyclohexane. Lannung (1) reported 14 values at temperatures of 283.15 to 310.15 K. Clever, Battino, Saylor and Gross (2) reported three values at temperatures of 287.35 to 313.65 K. Dymond (3) reported four values at temperatures of 290.95 to 309.45 K.

The smoothed values of both Lannung and of Dymond have a small positive temperature coefficient. The smoothed values of Clever, et al. have a small negative temperature coefficient. One solubility value was definitely out of line from the others, it was the 313.65 K value of Clever, et al. That value, along with the 290.95 K value of Dymond, were deleted. The remaining values were fitted by a linear regression to an equation of Gibbs energy linear in temperature for the recommended thermodynamic values and solubilities.

The recommended thermodynamic values for the transfer of one mole of argon from the gas at 101.325 kPa (1 atm) to the hypothetical unit mole fraction solution are

$$\Delta G°/\text{J mol}^{-1} = - RT \ln X_1 = 527.96 + 52.359\ T$$

Std. Dev. $\Delta G°$ = 27.57; Coef. Corr. = 0.9982

$\Delta H°/\text{J mol}^{-1}$ = 527.96; $\Delta S°/\text{J K}^{-1}\text{ mol}^{-1}$ = -52.359

The recommended values of the mole fraction solubility at an argon pressure of 101.325 kPa and the Gibbs energy of solution are given as a function of temperature in Table 1.

Table 1. Solubility of argon in cyclohexane at 101.325 kPa. Recommended mole fraction solubility and Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/\text{J mol}^{-1}$
283.15	1.47	15,353
288.15	1.48	15,615
293.15	1.48	15,877
298.15	1.49	16,139
303.15	1.49	16,401
308.15	1.50	16,662
313.15	1.50	16,924
318.15	1.51	17,186

Walkley and Jenkins (4) measured the partial molal volume of argon in cyclohexane by dilatometry. Their value is 47.6 $cm^3\ mol^{-1}$ at 298.15 K.

1. Lannung, A. J. Am. Chem. Soc. 1930, 52, 68.
2. Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M. J. Phys. Chem. 1957, 61, 1078.
3. Dymond, J. H. J. Phys. Chem. 1967, 71, 1829.
4. Walkley, J.; Jenkins, W. I. Trans. Faraday.Soc. 1968, 64, 19.

Sisskind and Kasarnowsky (5) measured one value of the solubility of argon at 298.15 K and 50.7 x 10^2 kPa (50.7 bar). Assuming Henry's law is obeyed, the argon mole fraction solubility at 101.325 kPa is 1.46 x 10^{-3} which is in fair agreement with the recommended value above. (See data sheet, p. 277).

5. Sisskind, B.; Kasarnowsky, I. Z. Anorg. Chem. 1933, 215, 385.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Cyclohexane; C_6H_{12}; 110-82-7

ORIGINAL MEASUREMENTS:

Lannung, A.

J. Am. Chem. Soc. 1930, 52, 68 - 80.

VARIABLES:

T/K: 283.15 - 310.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

P. L. Long
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
283.15	1.47	0.308	0.319
283.15	1.47	0.309	0.320
291.15	1.48	0.307	0.327
291.15	1.48	0.307	0.327
291.15	1.47	0.306	0.326
293.15	1.47	0.306	0.328
293.15	1.48	0.307	0.329
293.15	1.47	0.306	0.328
298.15	1.48	0.305	0.333
298.15	1.48	0.305	0.333
298.15	1.47	0.304	0.332
310.15	1.48	0.302	0.343
310.15	1.50	0.305	0.346
310.15	1.48	0.301	0.342

The mol fraction solubilities and Ostwald coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = 300.08 + 53.175\ T$

Std. Dev. $\Delta G° = 10.7$, Coef. Corr. = 0.9998

See the evaluation sheer for argon + cyclohexane for the recommended Gibbs energy equation and solubility values.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCFDURE:

Gas absorption. The gas is presaturated with solvent vapor. The gas volume absorbed is the difference between initial and final gas volumes. The amount of solvent is determined by the weight of mercury displaced.

The apparatus is a modification of that of von Antropoff (1). A calibrated, combined all glass manometer and bulb is enclosed in an air thermostat. Mercury is used as the calibration and confining liquid. The solvent is degassed in the apparatus. The solvent and the gas are shaken together until equilibrium is established.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Linde's Liquid Air Factory. Contained 0.5 per cent by volume nitrogen.
2. Cyclohexane. Poulenc Frères. Shaken with fuming H_2SO_4, water washed, dried over P_2O_5. Distilled from P_2O_5 with rejection of first quarter. Distilled from sodium, m.p. 6.3° C.

ESTIMATED ERROR:

$\delta T/K = 0.03$

REFERENCES:

1. v. Antropoff, A.
Z. Electrochem. 1919, 25, 269.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Cyclohexane; C_6H_{12}; 110-82-7

ORIGINAL MEASUREMENTS:

Clever, H. L.; Battino, R.;
Saylor, J. H.; Gross, P. M.

J. Phys. Chem. 1957, *61*, 1078 - 1083.

VARIABLES:

T/K: 287.35 - 313.65
P/kPa: 101.325 (1 atm)

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
287.35	1.50	0.314	0.330
298.15	1.49	0.306	0.334
313.65	1.45	0.294	0.338

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -999.0 + 57.512\ T$

Std. Dev. $\Delta G°$ = 11.3, Coef. Corr. = 0.9999

For the recommended Gibbs energy equation see the evaluation of the argon + cyclohexane system.

The solubility values were adjusted to an argon partial pressure of 101.325 kPa (1 atm) by Henry's Law.

The Bunsen coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric method. The solvent is saturated with gas as it flows through an 8 mm x 180 cm glass spiral attached to a gas buret. The total pressure is maintained at 1 atm as the gas is absorbed.

The apparatus is a modification of that of Morrison and Billett (1). The modifications include the addition of a spiral storage for the solvent, a manometer for a constant reference pressure, and an extra buret for highly soluble gases. The solvent is degassed by a modification of the method of Baldwin and Daniel (2).

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co. Both research and standard grades were used with no difference in results.

2. Cyclohexane. Phillips Petroleum Co. Used as received.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/mmHg = 3$
$\delta X_1/X_1 = 0.02$

REFERENCES:

1. Morrison, T. J.; Billett, F.
J. Chem. Soc. 1948, 2033;
Ibid. 1952, 3819.

2. Baldwin, R. R.; Daniel, S. G.
J. Appl. Chem. 1952, *2*, 161.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Cyclohexane; C_6H_{12}; 110-82-7

ORIGINAL MEASUREMENTS:

Dymond, J. H.

J. Phys. Chem. 1967, 71, 1829-1831.

VARIABLES:

T/K: 290.95 - 309.45
P/kPa: 101.325 (1 atm)

PREPARED BY:

M. E. Derrick

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
290.95	1.525	0.318	0.338
298.27	1.520	0.314	0.343
304.20	1.520	0.311	0.347
309.45	1.530	0.311	0.353

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = 104.29 + 53.584\ T$

Std. Dev. $\Delta G°$ = 7.49, Coef. Corr. = 0.9998

See the evaluation of the argon + cyclohexane system for the recommended Gibbs energy equation and the smoothed solubility values.

The Bunsen and Ostwald coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Saturation of liquid with gas at partial pressure of gas equal to 1 atm.

Dymond-Hildebrand apparatus (1) using an all-glass pumping system to spray slugs of degassed solvent into the gas/ Amount of gas dissolved calculated from initial and final gas pressures.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Linde Co. Dried.

2. Cyclohexane. Matheson, Coleman and Bell chromatoquality reagent. Dried and fractionally frozen. m.p. 6.45° C.

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.01$

REFERENCES:

1. Dymond, J.; Hildebrand, J. H. Ind. Eng. Chem. Fundam. 1967, 6, 130.

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. Methylcyclohexane; $C_6H_{11}CH_3$; 108-87-2	H. L. Clever Department of Chemistry Emory University Atlanta, GA 30322 U.S.A. June 1979

CRITICAL EVALUATION:

The solubility of argon in methylcyclohexane at an argon partial pressure of 101.325 kPa (1 atm) was measured at four temperatures between 262.90 and 298.14 by Reeves and Hildebrand (1), at three temperatures between 298.15 and 316.25 K by Clever, Battino, Saylor, and Gross (2), and at the temperature of 298.15 K by Saylor,and Battino (3). Sisskind and Kasarnowsky (4) made one measurement at 298.15 K and a pressure of 5.07 x 10^3 kPa (50 atm).

The three sets of data measured at 101.325 kPa argon partial pressure agree within one percent which is well within experimental error. The Gibbs energy of solution values from the three papers were fitted to an equation linear in temperature by a linear regression. The recommended changes in thermodynamic properties for the transfer of one mole of argon from the gas at a pressure of 101.325 kPa to the hypothetical unit mole fraction solution are

$$\Delta G°/J\ mol^{-1} = -\ RT\ ln\ X_1 = -1346.9 + 56.842\ T$$

$$Std.\ Dev.\ \Delta G° = 3.9, \quad Coef.\ Corr. = 0.9999$$

$$\Delta H°/J\ mol^{-1} = -1346.9, \quad \Delta S°/J\ K^{-1}\ mol^{-1} = -56.842$$

Table 1 gives the recommended mole fraction solubilities and Gibbs energy change as a function of temperature. If one assuems Henry's law, the Sisskind and Kasarnowsky mole fraction solubility at 298.15 K and 101.325 kPa is 1.80 x 10^{-3} which is in fair agreement with the recommended value.(p. 278)

Table 1. The solubility of argon in methylcyclohexane. The recommended mole fraction solubility at 101.325 kPa argon pressure and the Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/J\ mol^{-1}$
258.15	2.011	13,327
268.15	1.964	13,895
278.15	1.922	14,464
288.15	1.884	15,032
298.15	1.849	15,601
308.15	1.816	16,169
318.15	1.786	16,738

Jolley and Hildebrand (5) report the partial molal volume of argon in methylcyclohexane to be (44 ± 1) $cm^3\ mol^{-1}$ at 298.15 K by a dilatometer method.

1. Reeves, L. W.; Hildebrand, J. H. J. Am. Chem. Soc. 1957, 79, 1313.
2. Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M. J. Phys. Chem. 1957, 61, 1078.
3. Saylor, J. H.; Battino, R. J. Phys. Chem. 1958, 62, 1334.
4. Sisskind, B.; Kasarnowsky, I. Z. Anorg. Chem. 1933, 214, 385.
5. Jolley, J. E.; Hildebrand, J. H. J. Am. Chem. Soc. 1958, 80, 1050.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Methylcyclohexane; $C_6H_{11}CH_3$; 108-87-2

ORIGINAL MEASUREMENTS:

Reeves, L. W.; Hildebrand, J. H.

J. Am. Chem. Soc. 1957, 79, 1313-1314.

VARIABLES:

T/K: 262.90 - 298.14
P/kPa: 101.325 (1 atm)

PREPARED BY:

T. D. Kittredge

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
262.90	1.9888	0.362	0.348
272.53	1.9433	0.350	0.349
286.75	1.8872	0.344	0.361
298.14	1.8543	0.324	0.354

The Bunsen and Ostwald coefficients were calculated by the compiler.

Smoothed Data: $\Delta G^0/\text{J mol}^{-1} = -RT \ln X_1 = -1296.6 + 56.660\ T$

Std. dev. $\Delta G^0 = 3.8$, coef. corr. = 0.9999

$\Delta H^0/\text{J mol}^{-1} = -1296.6$, $\Delta S^0/\text{J K}^{-1}\text{ mol}^{-1} = -56.660$

See the evaluation of the argon + methylcyclohexane system for the recommended equation and table of solubility values.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus is a modified version of the apparatus of Cook and Hanson (1). The gas is measured and admitted to the degassed solvent. The apparatus is shaken for five minutes. The residual gas is measured. The procedure is repeated until the residual gas volume does not change.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Linde Co. Standard grade, 99.9 per cent pure by spectroscopic analysis.

2. Methylcyclohexane. Source not given. Spectro-grade. Passed through a silica gel column, distilled through a vacuum jacketed column at a reflux ratio of 15:1. Normal boiling point 100.9 ± 0.05 °C., density 0.76505 g cm^{-3} at 298.15 K.

ESTIMATED ERROR:

$\delta T/K = 0.001$
$\delta X_1/X_1 = 0.001$

REFERENCES:

1. Cook, M. W.; Hanson, D. N. Rev. Sci. Instr. 1956, 60, 615.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Methylcyclohexane; $C_6H_{11}CH_3$; 108-87-2

ORIGINAL MEASUREMENTS:

Clever, H. L.; Battino, R.
Saylor, J. H.; Gross, P. M.

J. Phys. Chem. 1957, *61*, 1078-1083.

VARIABLES:

T/K: 289.15 - 316.25
P/kPa: 101.325 (1 atm)

PREPARED BY:

P. L. Long
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
289.15	1.86	0.330	0.349
303.15	1.83	0.319	0.354
316.25	1.79	0.307	0.355

The solubility values were adjusted to a partial pressure of argon of 101.325 kPa (1 atm) by Henry's law.

The Bunsen coefficents were calculated by the compiler.

Smoothed Data: $\Delta G^0/J\ mol^{-1} = -RT \ln X_1 = -1077.2 + 55.986\ T$

Std. dev. $\Delta G^0 = 6.4$, Coef. corr. = 0.9998

$\Delta H^0/J\ mol^{-1} = -1077.2$, $\Delta S^0/J\ K^{-1}\ mol^{-1} = -55.986$

For the recommended Gibbs energy equation and the smoothed values of mole fraction solubility see the evaluation sheet on the argon + methylcyclohexane system.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solvent is saturated with the gas as it flows in a thin film through an 0.8 x 180 cm glass helix attached to the top of a gas buret. The total pressure of solute gas plus solvent vapor in maintained at one atm as the gas is absorbed.

The apparatus is a modification of the apparatus of Morrison and Billett (1). The modifications include the addition of a helical storage for the solvent, a manometer for a constant reference pressure, and an extra buret for the use with highly soluble gases. The solvent is degassed by a modification of the method of Baldwin and Daniel (2).

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co. Both standard and research grades were used with no difference in results.

2. Methylcyclohexane. Eastman Kodak Co. white label. Dried over Na, distilled, corrected b.p. 100.95-100.97 °C.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/mmHg = 3$
$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033; *Ibid.* 1952, 3819.

2. Baldwin, R. R.; Daniel, S. G. *J. Appl. Chem.* 1952, *2*, 161.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Methylcyclohexane; $C_6H_{11}CH_3$; 108-87-2

ORIGINAL MEASUREMENTS:

Saylor, J. H.; Battino, R.

J. Phys. Chem. 1958, 62, 1334 - 1337.

VARIABLES:

T/K: 298.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	1.85	0.324	0.354

The solubility value was adjusted to a partial pressure of argon of 101.325 kPa (1 atm) by Henry's law. The mole fraction and Bunsen solubility values were calculated by the compiler.

AUXILIARY INFORMATION

METHOD

The apparatus was based on the design by Morrison and Billett (1), and the version used was described by Clever, Battino, Saylor and Gross (2).

The degassed solvent was passed through a helical glass tube containing the gas and solvent vapor at a total pressure of 1 atm. The gas dissolves rapidly and the saturated liquid flows into a buret system. The volume of gas dissolved was determined by the increase in the liquid level in the buret system at constant pressure. The solvent volume was the sum of solvent in the buret system plus solvent passed through the system.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co. Research grade.
2. Methylcyclohexane. No information given.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 1$
$\delta X_1/X_1 = 0.02$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033.
2. Clever, H. L.; Battino, R. Saylor, J. H.; Gross, P. M. J. Phys. Chem. 1957, 61, 1078.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. cis-1,2-Dimethylcyclohexane; C_8H_{16}; 2207-01-4

ORIGINAL MEASUREMENTS:

Geller, E. B.; Battino, R.; Wilhelm, E.

J. Chem. Thermodyn. 1976, 8, 197-202.

VARIABLES:

T/K: 297.89
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
297.89	1.784	0.2829	0.3086

The solubility value was adjusted to an argon partial pressure of 101.325 kPa (1 atm) by Henry's law.

The Bunsen coefficient was calculated by the compiler.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass spiral tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Either Air Products & Chemicals, Inc., or Matheson Co., Inc. 99 mol per cent or better.
2. cis-1,2-Dimethylcyclohexane. Chemical Samples Co. Fractionally distilled and stored in dark. Refractive index (NaD, 298.15 K) 1.4337.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.005$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. J. Am. Oil Chem. Soc. 1968, 45, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. Anal. Chem. 1971, 43, 806.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. trans-1,2-Dimethylcyclohexane; C_8H_{16}; 6876-23-9

ORIGINAL MEASUREMENTS:

Geller, E. B.; Battino, R.; Wilhelm, E.

J. Chem. Thermodyn. 1976, 8, 197-202

VARIABLES:

T/K: 298.01
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.00	1.994	0.3081	0.3361
298.01	1.996	0.3084	0.3365
298.02	1.993	0.3080	0.3360

The Bunsen coefficients were calculated by the compiler.

The solubility values were adjusted to an argon partial pressure of 101.325 kPa (1 atm) by Henry's law.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Either Air Products & Chemicals Inc., or Matheson Co., Inc. 99 mol per cent or better.
2. trans-1,2-Dimethylcyclohexane. Chemical samples Co. Fractionally distilled and stored in dark. Refractive index (NaD, 298.15 K) 1.4248.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.005$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. J. Am. Oil Chem. Soc. 1968, 45, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. Anal. Chem. 1971, 43, 806.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. cis-1,3-Dimethylcyclohexane, 59 mol %; C_8H_{16}; 638-04-0
3. trans-1,3-Dimethylcyclohexane, 41 mol %; C_8H_{16}; 2207-03-6

ORIGINAL MEASUREMENTS:

Geller, E. B.; Battino, R.; Wilhelm, E.

J. Chem. Thermodyn. 1976, 8, 197-202.

VARIABLES:

T/K: 298.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	1.985	0.3053	0.3333

The Bunsen coefficient was calculated by the compiler.

The solubility value was adjusted to an argon partial pressure at 101.325 kPa (1 atm) by Henry's law.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Either Air Products & Chemicals, Inc., or Matheson Co., Inc. 99 mol per cent or better.
2. cis-1,4-Dimethylcyclohexane.
3. trans-1,4-Dimethylcyclohexane. Chemical Samples Co. Binary mixture used as received. Authors analyzed mixture by refractive index.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.005$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. J. Am. Oil Chem. Soc. 1968, 45, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. Anal. Chem. 1971, 43, 806.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. cis-1,4-Dimethylcyclohexane, 70 mol %; C_8H_{16}; 624-29-3
3. trans-1,4-Dimethylcyclohexane, 30 mol %; C_8H_{16}; 2207-04-7

ORIGINAL MEASUREMENTS:

Geller, E. B.; Battino, R.; Wilhelm, E.

J. Chem. Thermodyn. 1976, 8, 197-202.

VARIABLES:

T/K: 298.11
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.11	2.012	0.3110	0.3394

The Bunsen coefficient was calculated by the compiler.

The solubility values were adjusted to an argon partial pressure of 101.325 kPa (1 atm) by Henry's law.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared falsk and weighed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Either Air Products & Chemicals, Inc., or Matheson Co., Inc. 99 mol per cent or better.
2. cis-1,4-Dimethylcyclohexane.
3. trans-1,4-Dimethylcyclohexane. Chemical Samples Co. The binary mixture used as received. Composition determined by refractive index by authors.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.005$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. J. Am. Oil Chem. Soc. 1968, 45, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. Anal. Chem. 1971, 43, 806.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Cyclooctane; C_8H_{16}; 292-64-8

ORIGINAL MEASUREMENTS:

Wilcock, R. J.; Battino, R.; Wilhelm, E.

J. Chem. Thermodyn. 1977, 9, 111-115.

VARIABLES:

T/K: 298.11 - 313.54
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
289.11	1.226	0.2056	0.2176
298.14	1.300	0.2162	0.2360
313.54	1.293	0.3109	0.2431

The Bunsen coefficient was calculated by the compiler.

The solubility values were adjusted to an argon partial pressure of 101.325 kPa by Henry's law.

Smoothed Data: $\Delta G^o/J\ mol^{-1} = -RT \ln X_1 = 1413.8 + 50.715\ T$

Std. Dev. $\Delta G^o = 53.7$, Coef. Corr. = 0.996

$\Delta H^o/J\ mol^{-1} = 1413.8$, $\Delta S^o/J\ K^{-1}\ mol^{-1} = -50.715$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^o/J\ mol^{-1}$
288.15	1.243	16,027
293.15	1.256	16,281
298.15	1.268	16,535
303.15	1.280	16,788
308.15	1.292	17,042
313.15	1.303	17,295
318.15	1.315	17,549

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass spiral tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co. Minimum purity 99.995 mol per cent.
2. Cyclooctane. Chemical Samples Co. 99 mol percent, distilled, refractive index (NaD, 298.15 K) 1.4562.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.005$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. J. Am. Oil Chem. Soc. 1968, 45, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. Anal. Chem. 1971, 43, 806.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Benzene; C_6H_6; 71-43-2

EVALUATOR:

H. L. Clever
Emory University
Department of Chemistry
Atlanta, Georgia 30322

June, 1979

CRITICAL EVALUATION:

The solubility of argon in benzene has been measured by Lannung (1), Clever, Battino, Saylor, and Gross (2), and by Byrne, Battino, and Danforth (3). Linford and Hildebrand measured the argon solubility in several benzene + 1,1,2-trichloro-1,2,2-trifluoroethane (Freon-113) mixtures, but not in the pure benzene (4).

The smoothed data of Lannung and of Clever, et al. agree within one percent at 283.15 K and 0.5 percent at 308.15 K. The values of Byrne, et al. agrees to 0.7 percent or better. The data are well within experimental error. All of the data points were used in a linear regression of Gibbs energy linear in temperature to obtain the recommended values of thermodynamic parameters and mole fraction solubility values.

The recommended thermodynamic values for the transfer of one mole of argon from the gas at 101.325 kPa to the hypothetical unit mole fraction solution are:

$$\Delta G°/\text{J mol}^{-1} = - RT \ln X_1 = 1534.72 + 53.334\ T$$

Std. Dev. $\Delta G°$ = 24.48, Coef. Corr. = 0.9987

$$\Delta H°/\text{J mol}^{-1} = 1534.72, \quad \Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -53.334$$

The recommended values of the mole fraction solubility at an argon partial pressure of 101.325 kPa and the Gibbs energy of solution are given as a function of temperature in Table 1.

TABLE 1. Solubility of argon in benzene at 101.325 kPa. Recommended mole fraction solubility and Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°$/J mol^{-1}
283.15	0.853	16,636
288.15	0.862	16,903
293.15	0.872	17,170
298.15	0.882	17,436
303.15	0.891	17,703
308.15	0.899	17,970
313.15	0.908	18,236
318.15	0.917	18,503

Walkley and Jenkins (5) measured the partial molal volume of argon in benzene by dilatometry. Their value is 44.6 $\text{cm}^3\ \text{mol}^{-1}$ at 298.15 K. Popov and Drakin (6) measured the partial molal volume by a density method at high pressure. Their values are:

P/atm	7.0	15.70	23.10	25.00	34.72	41.10	44.25
$\bar{V}_1/\text{cm}^3\ \text{mol}^{-1}$	36.6	37.6	37.7	38.5	39.2	39.6	39.4

The uncertainties in $\bar{V}_1$ decrease from ± 0.8 at 7 atm to ± 0.1 at pressures above 40 atm.

1. Lannung, A. J. Am. Chem. Soc. 1930, 52, 68.
2. Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M. J. Phys. Chem. 1957, 61, 1078.
3. Byrne, J. E.; Battino, R.; Danforth, W. F. J. Chem. Thermodynamics 1974, 6, 245.
4. Linford, R. G.; Hildebrand, J. H. J. Phys. Chem. 1969, 73, 4410.
5. Walkley, J.; Jenkins, W. J. Trans. Faraday Soc. 1968, 64, 19.
6. Popov. G. A.; Drakin, S. I. Zh. Fiz. Khim. 1974, 48, 631.

See page 279 for high pressure data on the system. The mole fraction solubility at 280.15 K and 101.325 kPa (Henry's law) is 5-9 % lower than recommende

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Benzene; C_6H_6; 71-43-2

ORIGINAL MEASUREMENTS:

Lannung, A.

J. Am. Chem. Soc., 1930, *52*, 68 - 80.

VARIABLES:

T/K: 286.15 - 308.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

P. L. Long.
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
286.15	0.864	0.220	0.230
286.15	0.861	0.219	0.229
287.15	0.864	0.217	0.228
291.15	0.870	0.220	0.234
291.15	0.858	0.217	0.231
291.15	0.873	0.221	0.236
293.15	0.876	0.221	0.237
293.15	0.860	0.217	0.233
293.15	0.880	0.222	0.238
298.15	0.885	0.222	0.242
298.15	0.865	0.217	0.237
298.15	0.889	0.223	0.243
308.15	0.904	0.224	0.253
308.15	0.884	0.219	0.247
308.15	0.916	0.227	0.256

Smoothed Data: $\Delta G°/J\ mol^{-1} = -\ RT \ln X_1 = 1604.02 + 53.103\ T$

Std. Dev. $\Delta G° = 27.2$, Coef. Corr. = 0.9978

For the recommended Gibbs free energy equation see the critical evaluation of argon in benzene.

The mole fraction solubility and the Ostwald coefficient were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas absorption. The gas is presaturated with solvent vapor. The gas volume absorbed is the difference between initial and final gas volumes. The amount of solvent is determined by the weight of mercury displaced.

The apparatus is a modification of that of von Antropoff (1). A calibrated, combined all glass manometer and bulb is enclosed in an air thermostat. Mercury is used as the calibration and confining liquid. The solvent is degassed in the apparatus. The solvent and the gas are shaken together until equilibrium is established.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Linde's Liquid Air Factory. Contained 0.5 volume per cent nitrogen.
2. Benzene. Kahlbaum, "zur Molekulargewichtsbestimmung". Melting point 5.48° C.

ESTIMATED ERROR:

$\delta T/K = 0.03$

REFERENCES:

1. v. Antropoff, A.
Z. Electrochem. 1919, *25*, 269.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Benzene; C_6H_6; 71-43-2

ORIGINAL MEASUREMENTS:

Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M.

J. Phys. Chem. 1957, 61, 1078 - 1083.

VARIABLES:

T/K: 287.15 - 313.45
P/kPa: 101.325 (1 atm)

PREPARED BY:

P. L. Long
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
287.15	0.870	0.221	0.232
298.15	0.877	0.220	0.240
313.45	0.906	0.223	0.256

Smoothed Data: $\Delta G°/\text{J mol}^{-1} = -RT \ln X_1 = 1191.8 + 54.473\,T$

Std. Dev. $\Delta G° = 14.0$, Coef. Corr. = 0.9998

For the recommended free energy equation see the critical evaluation of the solubility of argon in benzene.

The Bunsen coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric. The solvent is saturated with gas as it flows through an 8 mm x 180 cm glass spiral attached to a gas buret. The total pressure is maintained at 1 atm as the gas is absorbed.

The apparatus is a modification of that of Morrison and Billett (1). The modifications include the addition of a spiral storage for the solvent, a manometer for a constant reference pressure, and an extra buret for highly soluble gases. The solvent is degassed by a modification of the method of Baldwin and Daniel (2).

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co. Both standard and research grade were used with no difference in results.
2. Benzene. Jones & Laughlin Steel Co., Pittsburgh, PA. Shaken with H_2SO_4, water washed, dried over sodium, and distilled.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/\text{mmHg} = 3$
$\delta X_1/X_1 = 0.02$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033; Ibid. 1952, 3819.
2. Baldwin, R. R.; Daniel, S. G. J. Appl. Chem. 1952, 2, 161.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Benzene; C_6H_6; 71-43-2

ORIGINAL MEASUREMENTS:

Byrne, J. E.; Battino, R.; Danforth, W. F.

J. Chem. Thermodynamics 1974, 6, 245 - 250.

VARIABLES:

T/K: 310.64, 310.69
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
310.64	0.906	0.2238	0.2545
310.69	0.906	0.2237	0.2544

The mole fraction solubilities and Bunsen coefficients were calculated by the compiler.

For the recommended Gibbs energy equation and solubility values, see the evaluation of the argon + benzene system.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCFDURE:

The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is applied intermittently through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass spiral tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Inc. Better than 99 mol per cent.
2. Benzene. Baker Analyzed Reagent Grade. Thiophene free, 99.9 mol per cent.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.005$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033
2. Battino, R.; Evans, F. D.; Danforth, W. F. J. Am. Oil Chem. Soc. 1968, 45, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. Anal. Chem. 1971, 43, 806.

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. Methylbenzene or Toluene; $C_6H_5CH_3$; 108-88-3	H. L. Clever Department of Chemistry Emory University Atlanta, GA 30322 U.S.A. June 1979

CRITICAL EVALUATION:

The solubility of argon in methylbenzene at an argon partial pressure of 101.325 kPa (1 atm) was measured at 11 temperatures between 288.22 and 303.31 K by Reeves and Hildebrand (1) and at four temperatures between 288.15 and 328.15 K by Saylor and Battino (2). Sisskind and Kasarnowsky (3) made measurements of the solubility at 273.15 and 280.15 K at pressures between 2.53×10^3 and 7.60×10^3 kPa argon pressure.

A linear regression of the Gibbs energy and temperature indicated the 288.15 and 298.15 K values of Saylor and Battino were slightly below the other values (1,2). The recommended values come from a linear regression of Gibbs energy and temperature using all of the Reeves and Hildebrand data and the values at 313.15 and 328.15 K of Saylor and Battino.

The recommended thermodynamic values for the transfer of one mole of argon from the gas at 101.325 kPa (1 atm) to the hypothetical unit mole fraction solution are

$$\Delta G°/\text{J mol}^{-1} = - RT \ln X_1 = 728.50 + 54.225\ T$$

Std. Dev. $\Delta G°$ = 5.18, Coef. Corr. = 0.99996

$\Delta H°/\text{J mol}^{-1} = 728.50$, $\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -54.225$

The recommended values of the mole fraction solubility at 101.325 kPa and the Gibbs energy of solution are given as a function of temperature in Table 1. If the data of Sisskind and Kasarnowsky are assumed to obey Henry's Law the solubility at 273.15 K is 0.973×10^{-3} mole fraction argon which is about 9 per cent below the value predicted by the recommended equation.

Table 1. Solubility of argon in methylbenzene. Recommended mole fraction solubility at 101.325 kPa argon pressure and Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/\text{J mol}^{-1}$
288.15	1.085	16,354
298.15	1.096	16,896
308.15	1.107	17,438
318.15	1.117	17,980
328.15	1.126	18,523

Jolley and Hildebrand (4) report the partial molal volume of argon in methylbenzene to be (45 ± 1) $\text{cm}^3\text{ mol}^{-1}$ at 298.15 K by a dilatometer measurement.

1. Saylor, J. H.; Battino, R. _J. Phys. Chem._ 1958, _62_, 1334.
2. Reeves, L. W.; Hildebrand, J. H. _J. Am. Chem. Soc._ 1957, _79_, 1313.
3. Sisskind, B.; Kasarnowsky, I. _Z. Anorg. Chem._ 1933, _214_, 385.
4. Jolley, J. E.; Hildebrand, J. H. _J. Am. Chem. Soc._ 1958, _80_, 1050.

COMPONENTS:

1. Argon; Ar; 7740-37-1
2. Methylbenzene (Toluene); C_7H_8 108-88-3

ORIGINAL MEASUREMENTS:

Saylor, J. H.; Battino, R.

J. Phys. Chem. 1958, 62, 1334-1337.

VARIABLES:

T/K: 288.15 - 328.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
288.15	1.07	0.228	0.240
298.15	1.09	0.228	0.249
313.15	1.11	0.229	0.262
328.15	1.13	0.229	0.275

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = A + BT = 1049.4 + 53.2\ T$

Std. Dev. $\Delta G° = 3.9$, Coef. Corr. = 0.99999

$\Delta H°/J\ mol^{-1} = 1{,}049.4$, $\Delta S°/J\ K^{-1}\ mol^{-1} = -53.2$

See the evaluation of the argon + methylbenzene system for the recommended thermodynamic equation and table of smoothed solubility values.

The solubility values were adjusted to a partial pressure of argon gas of 101.325 kPa (1 atm) by Henry's law.
The Bunsen coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was based on the design by Morrison and Billett (1), and the version used was described by Clever, Battino, Saylor, and Gross (2).

The degassed solvent was passed through a helical glass tube containing the gas. The gas dissolves rapidly and the saturated liquid flows into a buret system. The volume of gas dissolved was determined by the increase in the liquid level in the buret system at constant pressure. The volume of the solvent was determined in the burets.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Research grade.
2. Toluene. Mallinckrodt. Reagent grade. Shaken over conc. H_2SO_4, water washed, dried over Drierite, distilled b.p. 110.40-110.60° C.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 1$
$\delta X/X = 0.02$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033.
2. Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M. J. Phys. Chem. 1957, 61, 1078.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Methylbenzene or Toluene; $C_6H_5(CH_3)$; 108-88-3

ORIGINAL MEASUREMENTS:

Reeves, L. W.; Hildebrand, J. H.

J. Am. Chem. Soc. 1957, 79, 1313-1314

VARIABLES:

T/K: 288.22 - 303.31
P/kPa: 101.325 (1 atm)

PREPARED BY:

T. D. Kittredge
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
288.23	1.0882	0.231	0.244
288.22	1.0875	0.231	0.244
293.04	1.0918	0.231	0.248
293.03	1.0921	0.231	0.248
297.87	1.0963	0.230	0.251
297.87	1.0949	0.230	0.251
297.86	1.0943	0.230	0.251
297.88	1.0955	0.230	0.251
298.20	1.0950	0.230	0.251
303.31	1.0982	0.229	0.254
303.31	1.0995	0.230	0.255

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = 479.60 + 55.067\ T$

Std. Dev. $\Delta G° = 1.7$, Coef. Corr. = 0.9999

$\Delta H°/J\ mol^{-1} = 479.60$, $\Delta S°/J\ K^{-1}\ mol^{-1} = -55.067$

See the evaluation of the argon + toluene system for the recommended equation and table of solubility values.

AUXILIARY INFORMATION

METHOD:

APPARATUS/PROCEDURE: The apparatus is a modified version of the apparatus of Cook and Hanson (1). The gas is measured at various pressures and admitted to the degassed solvent. The apparatus is shaken for 5 min. The residual gas is measured. The procedure is repeated until the residual gas volume does not change.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Linde Co. Standard grade, 99.9 percent pure by spectroscopic analysis.
2. Methylbenzene. Source not given. Distilled, normal b.p. (110.60 ± 0.01)°C, density 0.8623 g cm^{-3} at 25°C.

ESTIMATED ERROR:

$\delta T/K = 0.001$
$\delta X_1/X_1 = 0.001$

REFERENCES:

1. Cook, M. W.; Hanson, D. N. Rev. Sci. Instr. 1957, 28, 370-374.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1,2-Dimethylbenzene or *o*-Xylene; C_8H_{10}; 95-47-6

ORIGINAL MEASUREMENTS:

Byrne, J. E.; Battino, R.; Wilhelm, E.

J. Chem. Thermodyn. 1975, *7*, 515-522.

VARIABLES:

T/K: 283.06 - 313.11
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
283.06	1.080	0.2028	0.2102
283.25	1.069	0.2007	0.2081
283.71	1.085	0.2035	0.2114
298.16	1.084	0.2006	0.2190
298.24	1.080	0.1999	0.2183
313.10	1.089	0.1988	0.2279
313.11	1.090	0.1990	0.2281

The Bunsen coefficients were calculated by the compiler. The solubility values were adjusted to an argon partial pressure of 101.325 kPa (1 atm) by Henry's law.

Smoothed Data: $\Delta G^o/J\ mol^{-1} = -RT \ln X_1 = 260.89 + 55.892\ T$

Std. Dev. $\Delta G^o = 10.8$, Coef. Corr. = 0.9999

$\Delta H^o/J\ mol^{-1} = 260.89$, $\Delta S^o/J\ K^{-1}\ mol^{-1} = -55.892$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^o/J\ mol^{-1}$
278.15	1.075	15,807
288.15	1.078	16,366
298.15	1.083	16,925
308.15	1.087	17,484
318.15	1.091	18,043

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Either Air Products & Chemicals, Inc., or Matheson Co., Inc. 99 mol per cent or better.
2. 1,2-Dimethylbenzene. Phillips Petroleum Co. Pure grade.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.005$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1,3-Dimethylbenzene or m-Xylene; C_8H_{10}; 108-38-3

ORIGINAL MEASUREMENTS:

Byrne, J. E.; Battino, R.; Wilhelm, E.

J. Chem. Thermodyn. 1975, 7, 515-522.

VARIABLES:

T/K: 283.21 - 313.71
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
283.21	1.187	0.2188	0.2269
283.40	1.186	0.2186	0.2268
298.19	1.188	0.2157	0.2355
298.21	1.185	0.2153	0.2350
313.16	1.185	0.2120	0.2431
313.71	1.185	0.2117	0.2431

The Bunsen coefficients were calculated by the compiler. The solubility values were adjusted to an argon partial pressure of 101.325 kPa (1 atm) by Henry's law.

Smoothed Data: $\Delta G^\circ/\text{J mol}^{-1} = -RT \ln X_1 = -31.73 + 56.121\,T$

Std. Dev. $\Delta G^\circ = 2.2$, Coef. Corr. = 0.9999

$\Delta H^\circ/\text{J mol}^{-1} = -31.73$, $\Delta S^\circ/\text{J K}^{-1}\text{ mol}^{-1} = -56.121$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^\circ/\text{J mol}^{-1}$
288.15	1.187	16,140
298.15	1.186	16,701
308.15	1.185	17,262
318.15	1.185	17,823

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is applied intermittently through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Either Air Products & Chemicals, Inc., or Matheson Co., Inc. 99 mol per cent or better.
2. 1,3-Dimethylbenzene. Phillips Petroleum Co. Pure grade.

ESTIMATED ERROR:

T/K = 0.03
P/mmHg = 0.5
X_1/X_1 = 0.005

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. J. Am. Oil Chem. Soc. 1968, 45 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. Anal. Chem. 1971, 43, 806.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1,4-Dimethylbenzene (*p*-Xylene); C_8H_{10}; 106-42-3

ORIGINAL MEASUREMENTS:

Clever, H.L.

J. Phys. Chem. 1957, *61*, 1082-1083.

VARIABLES:

T/K: 303.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

C.E. Edelman
A.L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
303.15	1.25	0.225	0.250

The solubility values were adjusted to a partial pressure of argon of 101.325 kPa (1 atm) by Henry's law.

The Bunsen coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD:

Volumeteric. The solvent is saturated with gas as it flows through an 8 mm x 180 cm glass helix attached to a gas buret. The total pressure of solute gas plus solvent vapor is maintained at 1 atm as the gas is absorbed.

APPARATUS/PROCEDURE:

The apparatus is a modification of the apparatus of Morrison and Billett (1). The modifications include the addition of a helical storage for the solvent, a manometer for a reference pressure, and an extra buret for highly soluble gases. The solvent is degassed by a modification of the method of Baldwin and Daniel (2).

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co.
2. 1,4-Dimethylbenzene. Eastman Kodak white label. Fractionally crystalized twice, dried over Na, distilled, b.p. 138.0-138.2°C.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/mmHg = 3$
$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Morrison, T.J.; Billett, F. *J. Chem. Soc.* 1948, 2033; *Ibid.* 1952, 3819.
2. Baldwin, R.R.; Daniel, S.G. *J. Appl. Chem.* 1952, *2*, 161.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1,4-Dimethylbenzene or p-Xylene; C_8H_{10}; 106-42-3

ORIGINAL MEASUREMENTS:

Byrne, J. E.; Battino, R.; Wilhelm, E.

J. Chem. Thermodyn. 1975, 7, 515-522.

VARIABLES:

T/K: 288.10 - 313.21
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
288.10	1.246	0.2279	0.2404
288.17	1.245	0.2278	0.2403
298.06	1.241	0.2247	0.2452
298.08	1.247	0.2259	0.2465
298.17	1.246	0.2256	0.2463
313.11	1.246	0.2223	0.2548
313.21	1.241	0.2213	0.2537

The Bunsen coefficients were calculated by the compiler.

The solubility values were adjusted to an argon partial pressure of 101.325 kPa (1 atm) by Henry's law.

Smoothed Data: $\Delta G^0/\mathrm{J\ mol^{-1}} = -RT \ln X_1 = -50.7 + 55.785\ T$

Std. Dev. $\Delta G^0 = 2.3$, Coef. corr. = 0.9999

$\Delta H^0/\mathrm{J\ mol^{-1}} = -50.7$, $\Delta S^0/\mathrm{J\ K^{-1}\ mol^{-1}} = -55.785$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^0/\mathrm{J\ mol^{-1}}$
288.15	1.245	16,024
298.15	1.244	16,582
308.15	1.244	17,139
318.15	1.243	17,697

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

See data sheets for either the 1,2- or the 1,3-dimethylbenzene + argon system from this paper for details of the method.

EVALUATION:

Clever, see preceding page, reported a value of the argon solubility in 1,4-dimethylbenzene at 303.15 K which agrees within 0.5 per cent of the smoothed value from this paper.

The smoothed data of Byrne, Battino, and Wilhelm is classed at tentative data for the argon + 1,4-dimethylbenzene. It is classed as tetntative because there is no confirmation of the temperature coefficient of solubility at this time.

June 1979

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Inc. 99.995 per cent.
2. 1,4-Dimethylbenzene. Phillips Petroleum Co. Pure Grade. Used as received.

ESTIMATED ERROR:

$\delta T/K = 0.01$
$\delta P/\mathrm{mmHg} = 0.5$
$\delta X_1/X_1 = 0.01$

REFERENCES:

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. Alcohols, Aldehydes, Ketones, and Carboxylic Acids	H. L. Clever Department of Chemistry Emory University Atlanta, GA 30322 U.S.A. July 1979

CRITICAL EVALUATION:

There are individual evaluation sheets for the solubility of argon in methanol, ethanol, 1-propanol, and 1-butanol. The evaluation sheets give either tentative or recommended values of the mole fraction solubility at an argon partial pressure of 101.325 kPa (1 atm) over a temperature interval.

The argon solubility data at high pressure have not been correlated with the low pressure data. Sisskind and Kasarnowsky (11) report the solubility of argon in many polar oxygen containing compounds. Their data and others' data are compiled in a later section of the volume. One can use Henry's Law to approximate the atmospheric pressure solubility, $X_1 = P_1/K_1$ from the high pressure data. Graham and Weale (5) showed that for many systems the solubility isotherm is better reproduced by an equation $S = aP + bP^2$ or $S/P = a + bP$. When the solubility data is over a range of pressure the Graham and Weale approach may be more useful than Henry's law.

There are other solubility data that either we could not obtain or we could not use in the form the data are presented in the original papers. Krestov and Nedel'ko report thermodynamic characteristics of argon dissolution in alcohols (6), and in ketones, aldehydes and carboxylic acids (7) at temperatures between 273 and 313 K. The solubility values are not given in the papers, but the Gibbs energy of solution, calculated from $\Delta G^\circ_{soln} = - RT \ln (L/\rho) + RT \ln (0.082\ T)$, are given at temperatures of 273, 283, 293, 298, 303, and 308 K. In the Gibbs energy equation L is the Ostwald coefficient and ρ is the solution density. The calculation could be reversed to obtain the Ostwald coefficient from the Gibbs energy. We have not done the calculation. See page 80 for additional comment on the equation.

The compounds for which Krestov and Nedel'ko report the Gibbs energy of solution are alcohols: methanol, ethanol, 1-propanol, 1-butanol, 2-butanol, 2-methyl-1-propanol, 1-pentanol, 1-hexanol, and 1-octanol; ketones: 2-propanone, 2-butanone, 2-pentanone, 3-pentanone, 3-hexanone, and 4-heptanone; aldehydes: propanal, butanal, and pentanal; and carboxylic acids: acetic acid acid, propanoic acid and butanoic acid.

Krestov and Nedel'ko (9, 10) have reported thermodynamic data on the dissolution of argon in saturated hydrocarbons, cyclohexane, benzene and other aromatic hydrocarbons and amines. However, the papers were not available to us.

There are several systems that require specific comment.

Argon + 2-Methyl-1-propanol

Battino, Evans, Danforth, and Wilhelm (1) report the solubility of argon in 2-methyl-1-propanol at seven temperatures between 274 and 328 K. Krestov and Slyusar (8) report one value at 298.15 K. The Ostwald coefficients at 298.15 K from the two laboratories agree within 0.8 per cent, which is well within experimental error. The 298.15 K solubility value can be recommended, but the values at other temperatures are classed as tentative until confirmed by other workers.

Argon + 1-Pentanol

The solubility values of Boyer and Bircher (3) are five percent higher than the values of Gjaldbaek and Niemann (4). In general, the results from both the laboratories of Gjaldbaek and of Bircher have been reliable. Both sets of data are classed as tentative. However, the values of Gjaldbaek and Niemann are slightly preferred.

Argon + 1-Octanol

The solubility values of Boyer and Bircher (3) are 8 to 12 per cent higher than the values reported by Wilcock, Battino, Danforth and Wilhelm (12). Although both sets of data are classed as tentative the Wilcock <u>et al</u>. values are preferred because of their improved apparatus, better degassing

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. Alcohols, Aldehydes, Ketones, and Carboxylic Acids.	H. L. Clever Department of Chemistry Emory University Atlanta, Georgia 30322 U.S.A. July 1979

CRITICAL EVALUATION:

technique, and the fact that their solubility values decrease with temperature, as expected, for the system.

Argon + 1,2-Ethanediol

Both Gjaldbaek and Niemann (4) and Ben-Naim (2) report values of the solubility of argon in 1,2-ethanediol which differ by about six per cent. The values of Ben-Naim were read from a graph which adds uncertainty to the overall experimental uncertainty. Both sets of values are classed as tentative.

REFERENCES

1. Battino, R.; Evans, F. D.; Danforth, W. F.; Wilhelm, E. J. Chem. Thermodyn. 1971, 3, 743.
2. Ben-Naim, A. J. Phys. Chem. 1968, 72, 2998.
3. Boyer, F. L.; Bircher, L. J. J. Phys. Chem. 1960, 64, 1330.
4. Gjaldbaek, J. C.; Niemann, H. Acta Chem. Scand. 1958, 12, 1015.
5. Graham, E. B.; Weale, K. E. Progress in International Research on Thermodynamics and Transport Properties, Masi, J. F.; Tsai, D. H., Editors, Academic Press, New York, 1962, page 153.
6. Krestov, G. A.; Nedel'ko, B. E. Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1972, 15, 42.
7. Krestov, G. A.; Nedel'ko, B. E. Ibid, 1973, 16, 214.
8. Krestov, G. A.; Slyusar, V. P. Ibid, 1978, 21, 1294.
9. Krestov, G. A.; Nedel'ko, B. E. Tr. Ivanov. Khim.-Tekhnol. Inst. 1972, No. 14, 61.
10. Krestov, G. A.; Nedel'ko, B. E. Ibid, No. 15, 65.
11. Sisskind, B.; Kasarnowsky, I. Z. Anorg. Chem. 1933, 214, 385.
12. Wilcock, R. J.; Battino, R.; Danforth, W. F.; Wilhelm, E. J. Chem. Thermodyn. 1978, 10, 817 - 822.

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1. 2. Methanol; CH_3OH; 67-56-1	H. L. Clever Chemistry Department Emory University Atlanta, Georgia 30322 USA March, 1979

CRITICAL EVALUATION:

Lannung (1) reported 20 values of the solubility of argon in methanol between278.25 and 318.15 K, Boyer and Bircher (2) one value at 298.15 K, Clever and Reddy (3) one value at 303.15 K, and Ben-Naim (4) five values between 278.15 and 298.15 K.

The data of Lannung and of Ben-Naim agree within a few tenths of one percent over the common range of measurement between 278.15 and 298.15 K. The values of both Boyer and Bircher and of Clever and Reddy are 2 to 2.5 percent lower.

The recommended values are based on the data of Ben-Naim and of Lannung. Four of Lannung's values were not used. They were one value at 281.15 K, two values at 310.15 K, and one value at 318.15 K. The remaining values were fitted to a Gibbs energy of solution equation linear in temperature by a linear regression.

The recommended thermodynamic values for the transfer of one mole of argon from the gas at 101.325 kPa (1 atm) to the hypothetical unit mole fraction solution are

$$\Delta G^\circ/\mathrm{J\ mol^{-1}} = -RT \ln X_1 = -994.36 + 67.454\ T$$

$$\text{Std. Dev. } \Delta G^\circ = 7.08, \qquad \text{Coef. Corr.} = 0.9999$$

$$\Delta H^\circ/\mathrm{J\ mol^{-1}} = -994.36, \qquad \Delta S^\circ/\mathrm{J\ K^{-1}\ mol^{-1}} = -67.454$$

The recommended values of the mole fraction solubility at 101.325 kPa and the Gibbs energy of solution are given as a function of temperature in Table 1.

Table 1. Solubility of argon in methanol. Recommended mole fraction solubility at 101.325 kPa argon and Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^\circ/\mathrm{J\ mol^{-1}}$
278.15	0.461	17,768
283.15	0.457	18,105
288.15	0.454	18,442
293.15	0.451	18,780
298.15	0.447	19,117
303.15	0.442	19,454
308.15	0.439	19,792
313.15	0.439	20,129

The apparent molar volume of argon in methanol was measured at 100 atm at 303.15 K by Masterton, Robins, and Slowinski (5) to be 46 ± 1 $cm^3\ mol^{-1}$ and by a high pressure density method by Popov and Drakin (6) at 298.15 K who reported values of 48.5 ± 0.3, 48.9 ± 0.2, 48.7 ± 0.1, and 48.4 ± 0.1 $cm^3\ mol^{-1}$ at pressures of 12.2, 21.6, 32.8, and 53.8 atm, respectively.

1. Lannung, A. *J. Am. Chem. Soc.* 1930, *52*, 68.
2. Boyer, F. L.; Bircher, L. J. *J. Phys. Chem.* 1960, *64*, 1330.
3. Clever, H. L.; Reddy, G. S. *J. Chem. Eng. Data* 1963, *8*, 191.
4. Ben-Naim, A. *J. Phys. Chem.* 1967, *71*, 4002.
5. Masterton, W. L.; Robins, D. A.; Slowinski, E. J. *J. Chem. Eng. Data* 1961, *6*, 531.
6. Popov, G. A.; Drakin, S. I. *Moskov. Khimiko-technol. Inst. Trudy* 1972, *71*, 43.

See Page 282 for high pressure data on the system. The mole fraction solubility at 273.35 and 101.325 kPa (Henry's law) is 12 to 23 per cent higher than the value calculated from the recommended equation.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Methanol; CH_4O; 67-56-1

ORIGINAL MEASUREMENTS:

Lannung, A.

J. Am. Chem. Soc. 1930, *52*, 68-80.

VARIABLES:

T/K: 275.05 - 318.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

P. L. Long/A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
278.25	0.459	0.259	0.264
279.15	0.461	0.259	0.265
281.15	0.458	0.257	0.265
281.15	0.458	0.257	0.265
281.15	0.475	0.267	0.275
286.15	0.455	0.254	0.266
287.15	0.455	0.254	0.267
286.15	0.455	0.254	0.266
291.15	0.452	0.251	0.268
291.15	0.450	0.250	0.266
293.15	0.450	0.249	0.267
293.15	0.451	0.250	0.268
293.15	0.451	0.250	0.268
298.15	0.447	0.246	0.269
298.15	0.445	0.245	0.267
298.15	0.445	0.245	0.267
310.15	0.442	0.240	0.272
310.15	0.446	0.242	0.275
310.15	0.442	0.240	0.272
318.15	0.445	0.239	0.278

The mole fraction and Ostwald solubilities were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -881.13 + 67.044\ T$

Std. Dev. $\Delta G° = 22.8$, Coef. Corr. = 0.9996

$\Delta H°/J\ mol^{-1} = -881.13$, $\Delta S°/J\ K^{-1}\ mol^{-1} = -67.044$

See evaluation of argon + methanol for recommended equation.

AUXILIARY INFORMATION

METHOD:

Gas absorption. The absorbed volume of gas is calculated from the initial and final volumes, both saturated with solvent vapor. The amount of solvent is determined from the weight of the displaced mercury.

APPARATUS/PROCEDURE:

The apparatus used is a modification of that of von Antropoff (1). A calibrated combined all-glass manometer and bulb enclosed in an air thermostat is employed. Mercury is used as the calibration and confining liquids. The solvent was degassed in the apparatus. The liquid and gas were shaken together until equilibrium was established.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Linde's Liquid Air Factory contained 0.5% by volume nitrogen.
2. Methanol. B.A.S.F. Distilled from over freshly cut block magnesium, rejected first one-third.

ESTIMATED ERROR:

$\delta T/K = 0.03$

REFERENCES:

1. v. Antropoff, A.; *Z. Elektrochem.* 1919, *25*, 269.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Methanol; CH_3OH; 67-56-1

ORIGINAL MEASUREMENTS:

Boyer, F. L.; Bircher, L. J.

J. Phys. Chem. 1960, *64*, 1330 - 1331.

VARIABLES:

T/K: 298.15

Total P/kPa: 101.325 (1 atm)

PREPARED BY:

M. E. Derrick

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	0.445	0.245	0.267 ± 0.003

The Bunsen coefficient was calculated by the compiler.

The original paper gives the mole fraction solubility as 0.415×10^{-3}, however, Boyer (2) gives the observed solubility as 0.445×10^{-3}. The solubility in the orignial paper is apparently that calculated from the equation given in the thesis

$$\log X_1 = -3.381 + 0.573 \log C$$

where C is the number of carbon in the alcohol.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Commercial Van Slyke blood gas apparatus (E. H. Sargent Co.) was modified by the authors for their use.

The total pressure of gas and solvent vapor in the solution chamber was adjusted to a pressure of one atm. The pressure was maintained at one atm during the solution process.The saturated solution was transferred to a bulb below the lower stopcock of the the extraction vessel and sealed off. The gas and solvent vapor were then brought to volume over mercury. See (1) for details of the extraction procedure.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Ohio Surgical Co. 99.6 per cent argon.

2. Methanol. Source not given. Treated by standard methods to remove aldehydes and ketones, then dried and distilled.

ESTIMATED ERROR:

$\delta T/K = 0.01$

$\delta L/cm^3 = 0.003$

REFERENCES:

1. Peters, J. P.; Van Slyke, D. D. "Quantitative Clinical Chemistry" Williams and Wilkins Co., Baltimore, MD, 1932, Volume II.

2. Boyer, F. L. Ph.D. Dissertation Vanderbilt U., 1959, Nashville, TN

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Methanol; CH_4O; 67-56-1

ORIGINAL MEASUREMENTS:

Clever, H. L.; Reddy, G. S.

J. Chem. Eng. Data 1963, 8, 191-192.

VARIABLES:

T/K: 303.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
303.15	0.420	0.230	0.255

The mole fraction solubility value was calculated by the compiler.

See the evaluation sheet for the argon + methanol system for the recommended solubility values.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The apparatus was modeled after that of Markham and Kobe (1). A length of TRUEBORE tubing of 0.4643 cm^2 cross section was used as the gas buret. The volume of gas, presaturated with solvent, absorbed by 103.1 cm^3 of solution was measured.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Inc. Regular grade stated to be 99.998 per cent pure.
2. Methanol. Merk Chemical Co. Anhydrous grade.

ESTIMATED ERROR:

REFERENCES:

1. Markham, A. E.; Kobe, K. A. J. Am. Chem. Soc. 1941, 63, 449.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Methanol; CH_3OH; 67-56-1

ORIGINAL MEASUREMENTS:

Ben-Naim, A.

J. Phys. Chem. 1967, 71, 4002-4007.

VARIABLES:

T/K: 278.15 - 298.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
278.15	0.460	0.259	0.264
283.15	0.459	0.257	0.266
288.15	0.456	0.254	0.268
293.15	0.451	0.250	0.268
298.15	0.449	0.247	0.270

The mole fraction and Bunsen solubilities were calculated for 1 atm by the compiler from the Ostwald coefficient read from graph in the original paper.

Smoothed Data: $\Delta G°/\text{J mol}^{-1} = -RT \ln X_1 = -912.72 + 67.150\ T$

Std. Dev. $\Delta G° = 5.546$, Coef. Corr. = 0.9999

$\Delta H°/\text{J mol}^{-1} = -912.72$ $\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -67.150$

See the evaluation of the argon + ethanol system for the recommended equation.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

See the argon + methanol + water data sheet of Ben-Naim.

SOURCE AND PURITY OF MATERIALS:

No information given.

ESTIMATED ERROR:

$\delta L/L = 0.003$

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. Ethanol; C_2H_5OH; 64-17-5	H. L. Clever Chemistry Department Emory University Atlanta, Georgia 30322 USA March, 1979

CRITICAL EVALUATION:

The solubility of argon in ethanol was reported by three laboratories. Lannung (1) reported eight solubility values between 275.05 and 313.15 K., Boyer and Bircher (2) reported one value at 298.15 K, and Cargill and Morrison (3) reported eight values between 288.65 and 332.75 K.

At 298.15 K and 101.325 kPa argon pressure the mole fraction solubilities of argon in ethanol range from (0.620 - 0.636) x 10^{-3} (2.5 percent). The solubility values of Lannung and of Cargill and Morrison overlap over the 25 degree range between 288.65 and 313.15 K. Cargill and Morrison's data is higher valued over the temperature interval by 2.2 percent at 288 K and 0.5 percent at 313 K. Lannung distilled the alcohol twice before use from over quicklime. His argon contained 0.5 percent nitrogen but nitrogen and argon have similar solubilities. Cargill and Morrison used spectrograde absolute ethanol stated to be 99.8 mol percent ethanol. Their argon was stated to be 99.9 percent pure. The agreement between the two laboratories is within experimental error.

The solubility data from the three references was combined and a linear regression made of the standard Gibbs energy linear in temperature for the recommended values.

The recommended thermodynamic values for the transfer of one mole of argon from the gas at 101.325 kPa (1 atm) to the hypothetical unit mole fraction solution are

$$\Delta G°/\text{J mol}^{-1} = - RT \ln X_1 = -580.60 + 63.278\ T$$

$$\text{Std. Dev. } \Delta G° = 24.9, \quad \text{Coef. Corr.} = 0.9996$$

$$\Delta H°/\text{J mol}^{-1} = -580.60, \quad \Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -63.278$$

The recommended values of the mole fraction solubility at 101.325 kPa and the Gibbs energy of solution are given as a function of temperature in Table 1.

Table 1. The solubility of argon in ethanol. Recommended mole fraction solubility at an argon partial pressure of 101.325 kPa, and Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction X_1 x 10^3	$\Delta G°/\text{J mol}^{-1}$
273.15	0.6393	16,704
278.15	0.6364	17,020
283.15	0.6335	17,337
288.15	0.6308	17,653
293.15	0.6282	17,969
298.15	0.6257	18,286
303.15	0.6233	18,602
308.15	0.6210	18,919
313.15	0.6188	19,235
318.15	0.6166	19,551
323.15	0.6145	19,868
328.15	0.6125	20,184
333.15	0.6105	20,501

1. Lannung, A. J. Am. Chem. Soc. 1930, 52, 68.
2. Boyer, F. L.; Bircher, L. J. J. Phys. Chem. 1960, 64, 1330.
3. Cargill, R. W.; Morrison, T. J. J. Chem. Soc., Faraday Trans. I 1975 71, 618.

See page 283 for high pressure data on the system. The mole fraction solubility at 273.35 K and 101.325 kPa (Henry's law) is 4 to 25 per cent higher than the value calculated from the recommended equation.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Ethanol; C_2H_6O; 64-17-5

ORIGINAL MEASUREMENTS:

Lannung, A.

J. Am. Chem. Soc. 1930, 52, 68-80.

VARIABLES:

T/K: 275.05 - 318.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
275.05	0.633	0.248	0.250
291.15	0.628	0.242	0.258
293.15	0.622	0.239	0.256
293.15	0.619	0.238	0.255
293.15	0.632	0.243	0.261
298.15	0.620	0.237	0.259
308.15	0.614	0.232	0.262
313.15	0.625	0.235	0.269

The mole fraction and ostwald solubilities were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -392.35 + 62.682\ T$

Std. Dev. $\Delta G° = 20.9$, Coef. Corr. = 0.9996

$\Delta H°/J\ mol^{-1} = -392.35$, $\Delta S°/J\ K^{-1}\ mol^{-1} = -62.682$

See the evaluation of argon + ethanol for the recommended equation.

AUXILIARY INFORMATION

METHOD:

Gas absorption. The absorbed volume of gas is calculated from the initial and final volumes, both saturated with solvent vapor. The amount of solvent is determined from the weight of the displaced mercury (1).

SOURCE AND PURITY OF MATERIALS:

1. Argon. Linde's Liquid Air Factory. Contains 0.5% by volume nitrogen.
2. Ethanol. Alcohol absolutus, Ph. dan. Distilled twice from over freshly prepared quick lime.

APPARATUS/PROCEDURE:

The apparatus used is a modification of that of vonAntropoff (1). A calibrated combined all-glass manometer and bulb enclosed in an air thermostat is employed. Mercury is used as the calibration and confining liquids The solvent was degassed in the apparatus. The liquid and gas were shaken together until equilibrium was established.

ESTIMATED ERROR:

$\delta T/K = 0.03$

REFERENCES:

1. V. Antropoff, A.; Z. Elektrochem., 1919, 25, 269.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Ethanol; C_2H_5OH; 64-17-5

ORIGINAL MEASUREMENTS:

Boyer, F. L.; Bircher, L. J.

J. Phys. Chem. 1960, 64, 1330-1331.

VARIABLES:

T/K: 298.15

P/kPa: 101.325 (1 atm)

PREPARED BY:

M. E. Derrick

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	0.621	0.236	0.258 ± 0.002

The Bunsen coefficient was calculated by the compiler.

The observed mole fraction solubility was taken from Boyer's dissertation (2).

The Dissertation gives the equation $\log X_1 = -3.381 + 0.573 \log C$ at 298.15 K where C is the number of carbon atoms in the alcohol. The mole fraction solubility given in the original paper was calculated from the 298.15 K equation.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Commercial Van Slyke blood gas apparatus (E. H. Sargent Co.) was modified by the authors for their use.

The total pressure of gas and solvent vapor in the solution chamber was adjusted to a pressure of one atm. The pressure was maintained at one atm during the solution process. The saturated solution was transferred to a bulb below the lower stopcock of the extraction vessel and sealed off. The gas and solvent vapor were then brought to volume over mercury. See (1) for details of the extraction procedure.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Ohio Surgical Co. 99.6 per cent argon.
2. Ethanol. Source not given. Treated by standard methods to remove aldehydes and ketones, then dried and distilled.

ESTIMATED ERROR:

$\delta T/K = 0.01$

$\delta L/cm^3 = 0.002$

REFERENCES:

1. Peters, J. P.; Van Slyke, D. D. "Quantitative Clinical Chemistry" Williams and Wilkins Co., Baltimore, MD, 1932, Volume II.
2. Boyer, F. L. Ph.D. Dissertation Vanderbilt U., 1959, Nashville, TN

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Ethanol; C_2H_6O; 64-17-5

ORIGINAL MEASUREMENTS:

Cargill, R. W.; Morrison, T. J.

J. Chem. Soc. Faraday Trans. I 1975, 71, 618-634.

VARIABLES:

T/K: 288.65 - 332.75
P/kPa: 101.325 (1 atm)

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

T/K	cm^3 (STP) Ar kg^{-1} Ethanol	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
288.65	312.6	0.6421	0.2480	0.262
293.05	309.7	0.6362	0.2445	0.262
298.25	309.7	0.6362	0.2431	0.265
303.05	304.8	0.6261	0.2380	0.264
308.15	303.4	0.6232	0.2356	0.266
312.95	299.2	0.6146	0.2311	0.265
328.05	297.9	0.6119	0.2263	0.272
332.75	297.2	0.6105	0.2245	0.273

The Mole fraction, Bunsen and Ostwald solubilities were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -\ RT\ \ln X_1 = -\ 943.80 + 64.412\ T$

$\text{Std/ Dev. } \Delta G° = 13.46$, Coef. Corr. = 0.9999

$\Delta H°/J\ mol^{-1} = -943.80$, $\Delta S°/J\ M^{-1}\ mol^{-1} = -64.412$

See the argon + ethanol evaluation for the recommended equation.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

See Argon + Ethanol + Water data sheet of Cargill and Morrison.

SOURCE AND PURITY OF MATERIALS:

1. Argon. British Oxygen Co. Gas 99.9 per cent pure, stored over saturated brine.
2. Ethanol. Source not given. Spectroscopic grade, contained 0.002 mole fraction water.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta P/mmHg = 0.5$
solubility values reproducible within 0.5 percent (authors).

REFERENCES:

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. 1-Propanol; C_3H_8O; 71-23-8	H. L. Clever Chemistry Department Emory University Atlanta, Georgia 30322 U.S.A.

CRITICAL EVALUATION:

The solubility of argon in 1-propanol was measured in three laboratories. Gjaldbaek and Nieman (1) report two solubility values near 298.15 and three values near 308.15 K. Boyer and Bircher (2,3) report solubility values at 298.15 and 308.15 K. Komarenko and Manzhelii (4) report nine values between 163.15 and 243.15 K.

The solubility values of Gjaldbaek and Niemann and of Boyer and Bircher were combined to obtain a set of recommended values for the room temperature region. Boyer and Bircher's solubility value at 308.15K appears to be high and was omitted in the final fit to Gibbs energy equation linear in temperature by the method of least squares.

The recommended changes in the thermodynamic parameters for the transfer of one mole of argon from the gas at 101.325 kPa to the hypothetical unit mole fraction solution are

$$\Delta G°/J\ mol^{-1} = - RT \ln X_1 = - 1,725.0 + 65.320\ T$$

$$\text{Std. Dev. } \Delta G° = 10.0, \quad \text{Coef. Corr.} = 0.9996$$

$$\Delta H°/J\ mol^{-1} = 1,725.0, \quad \Delta S°/J\ K^{-1}\ mol^{-1} = -65.320.$$

The recommended solubility values and Gibbs energy as a function of temperature are in Table 1.

TABLE 1. Solubility of argon in 1-propanol. Recommended mole fraction solubility at 101.325 kPa and Gibbs energy change as a function of temperature.

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/J\ mol^{-1}$
298.15	0.777	17,750
303.15	0.768	18,077
308.15	0.759	18,403

Komarenko and Manzhelii measured the solubility of argon in 1-propanol at a gas partial pressure of 26.664 kPa (200 mm Hg). The compiler calculated 101.325 kPa (1 atm) partial pressure mole fraction solubility values assuming Henry's law to be valid. The 101.325 kPa solubility values were fitted to a three constant equation by the method of least squares. The smoothed values of the mole fraction solubility and the thermodynamic changes for the transfer of one mole of argon from the gas at a pressure of 101.325 kPa to the hypothetical unit mole fraction solution are given on the data sheet at 10 degree intervals for the 173.15 to 243.15 K temperature range. The authors used an ultrapure alcohol sample that was probably very dry. Their solubility values should be reliable.

It is unusual to be able to give a tentative set of solubility values over an extended temperature range. By combining the low temperature solubility values of Komarenko and Manzhelii with the room temperature values used above in a three constant equation, tentative solubility values of argon in 1-propanol can be obtained over a 145 degree temperature range.

The equation,

$$\ln X_1 = -11.7972 + 7.83004/(T/100) + 1.83978 \ln (T/100)$$

with a standard error about the regression line of 1.82×10^{-3}, was used to obtain the tentative values of solubility and thermodynamic changes for the transfer of one mole of argon from the gas phase at 101.325 kPa to the hypothetical unit mole fraction solution as a function of temperature. See Table 2.

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. 1-Propanol; C_3H_8O; 71-23-8	H. L. Clever Chemistry Department Emory University Atlanta, Georgia 30322 U.S.A.

CRITICAL EVALUATION:

TABLE 2. Solubility of argon in 1-propanol. Tentative mole fraction solubility at 101.325 kPa and values of changes in Gibbs energy, enthalpy, entropy, and heat capacity as a function of temperature.

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/kJmol^{-1}$	$\Delta H°/kJmol^{-1}$	$\Delta S°/J\ K^{-1}\ mol^{-1}$	$\Delta Cp°/J\ K^{-1}\ mol^{-1}$
173.15	1.90	9.109	-3.862	-74.39	15.30
183.15	1.65	9.759	-3.709	-73.53	15.30
193.15	1.46	10.490	-3.556	-72.72	15.30
203.15	1.31	11.213	-3.403	-71.95	15.30
213.15	1.19	11.929	-3.250	-71.21	15.30
223.15	1.10	12.638	-3.097	-70.51	15.30
233.15	1.03	13.340	-2.944	-69.84	15.30
243.15	0.966	14.035	-2.791	-69.20	15.30
253.15	0.916	14.724	-2.638	-68.58	15.30
263.15	0.875	15.406	-2.485	-67.99	15.30
273.15	0.840	15.083	-2.332	-67.42	15.30
283.15	0.811	16.755	-2.179	-66.87	15.30
293.15	0.787	17.421	-2.076	-66.34	15.30
298.15	0.776	17.752	-1.949	-66.08	15.30
303.15	0.766	18.082	-1.873	-65.82	15.30
308.15	0.757	18.410	-1.797	-65.57	15.30

1. Gjaldbaek, J. C.; Niemann, H. Acta Chem. Scand. 1958, 12, 1015.
2. Boyer, F. L.; Bircher, L. J. J. Phys. Chem. 1960, 64, 1330.
3. Boyer, F. L. Ph.D. Dissertation, Vanderbilt University, 1959.
4. Komarenko, V. G.; Manzhelii, V. G. Ukr. Fiz. Zh. (Uhr. Ed.) 1968, 13, 387.

See page 284 for high pressure data on the system. The single high pressure value of Sisskind and Kasarnowsky (5) when reduced to 273.35 K and 101.325 kPa is 14 per cent lower than the value calculated from the tentative equation.

5. Sisskind, B.; Kasarnowsky, I. Z. Anorg. Chem. 1933, 214, 385.

COMPONENTS:

1. Argon, Ar; 7440-37-1
2. 1-Propanol; C_3H_8O; 71-23-8

ORIGINAL MEASUREMENTS:

Gjaldbaek, J. C.; Niemann, H.

Acta Chem. Scand. 1958, *12*, 1015-1023

VARIABLES:

T/K: 298.15 - 308.15

PREPARED BY:

J. Chr. Gjaldbaek

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α*	Ostwald Coefficient L
298.15	0.776	0.2315	0.2527
298.16	0.774	0.2310	0.2521
308.21	0.755	0.2231	0.2517
308.13	0.762	0.2249	0.2537
308.15	0.761	0.2248	0.2536

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -1{,}562.1 + 64.791\ T$

Std. Dev. $\Delta G° = 9.2$, Coef. Corr. = 0.9997

$\Delta H°/J\ mol^{-1} = -1{,}562.1$, $\Delta S°/J\ K^{-1}\ mol^{-1} = -64.791$

See Evaluation of Argon + 1-propanol for recommended Gibbs energy equation and solubility values.

The Ostwald coefficient and mole fraction were calculated by the compiler.

Values at 1 atmosphere pressure assuming Henry's law is obeyed.

AUXILIARY INFORMATION

METHOD:

A calibrated all-galss combined manometer and bulb was enclosed in an air thermostat and shaken until equilibrium. Mercury was used for calibration and as confining liquid. The solvents were degassed in the apparatus. Details in ref. 1 and 2.

APPARATUS/PROCEDURE:

The absorbed volume of gas is calculated from the initial and final amounts, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury. Details in ref. 1 and 2.

SOURCE AND PURITY OF MATERIALS:

1. Argon. "L" air liquid. Dried, < 0.05 % H_2 .
2. 1-Propanol. Dried and distilled, b.p. 97.1 - 97.4°C, n(D, 293.15K) = 1.3856.

ESTIMATED ERROR:

$\delta T/K = 0.05$

$\delta X_1/X_1 = 0.015$

REFERENCES:

1. Lannung, A. *J. Am. Chem. Soc.* 1930, *52*, 68.
2. Gjaldbaek, J. C. *Acta Chem. Scand.* 1952, *6*, 623.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1-Propanol; C_3H_8O; 71-23-8

ORIGINAL MEASUREMENTS:

Boyer, F. L.; Bircher, L. J.

J. Phys. Chem. 1960, 64, 1330-1331.

VARIABLES:

T/K: 298.15 - 308.15

PREPARED BY:

M. E. Derrick

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	0.785	0.233	0.254 ± 0.002
308.15	0.792	0.234	0.264 ± 0.001

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = 699.63 + 57.1\ T$

$\Delta H°/J\ mol^{-1} = 699.63$, $\Delta S°/J\ K^{-1}\ mol^{-1} = -57.1$

The Bunsen Coefficient was calculated by the compiler.

The 308.15 K values are from Boyer (2). So is the mole fraction solubility at 298.15 K. The mole fraction solubility in the original paper of 0.782 x 10^{-3} was calculated from the authors equation.

AUXILIARY INFORMATION

METHOD:

Gas extracted from solvent followed by measurement of gas and solvent volumes (1).

APPARATUS/PROCEDURE:

Modified E. H. Sargent Co. manometric Van Slyke blood gas apparatus used. Total pressure of gas and vapor in the solution chamber adjusted to atmospheric pressure. The solvent was transferred to bulb below extraction vessel and sealed off. Gas and solvent vapors brought to volume over mercury (1).

SOURCE AND PURITY OF MATERIALS:

1. Argon. Ohio Surgical Co. 99.6 per cent.
2. 1-Propanol. Removed aldehydes and ketones, dried, and distilled by standard methods.

ESTIMATED ERROR:

$\delta T/K = 0.01$

$\delta L/L = 0.002$

REFERENCES:

1. Peters, J. P.; Van Slyke, D. D. "Qualitative Clinical Chemistry", Williams and Wilkins Co., Baltimore, Md., 1932, Vol. II.
2. Boyer , F. L. Ph.D. Dissertation, Vanderbilt Univ., Nashville, TN.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1-Propanol; C_3H_8O; 71-23-8

ORIGINAL MEASUREMENTS:

Komarenko, V.G.; Manzhelii, V.G.

Ukr.Fiz.Zh.(Ukr.Ed.) 1968, 13,387-391.
Ukr. Phys. J. 1968, 13, 273-276.

VARIABLES:

T/K: 173.15 - 243.15
P/kPa: 26.664 (200 mmHg)

PREPARED BY:

T.D. Kittredge
H.L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction P/mmHg 200 $X_1 \times 10^3$	Mol Fraction P/mmHg 760 $X_1 \times 10^3$
173.15	0.496	1.88
183.15	0.4315	1.640
193.15	0.389	1.48
203.15	0.345	1.31
213.15	0.3185	1.210
223.15	0.2945	1.119
233.15	0.272	1.03
243.15	0.243	0.923

Smoothed Data: $\ln X_1 = -6.96820 + 2.12458/(T/100) - 0.987421 \ln (T/100)$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^\circ/\text{kJmol}^{-1}$	$\Delta H^\circ/\text{kJmol}^{-1}$	$\Delta S^\circ/\text{JK}^{-1}\text{mol}^{-1}$	$\Delta C_p^\circ/\text{JK}^{-1}\text{mol}^{-1}$
173.15	1.87	9.046	-3.188	-70.65	-8.21
183.15	1.65	9.75	-3.271	-71.11	"
193.15	1.48	10.47	-3.352	-71.55	"
203.15	1.33	11.19	-3.434	-71.96	"
223.15	1.10	12.63	-3.598	-72.74	"
233.15	1.02	13.36	-3.681	-73.10	"
243.15	0.938	14.09	-3.762	-73.44	"

The mole fraction solubility at 101.325 kPa (760 mmHg) was calculated by Henry's law by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solvent was degassed by vacuum. A thin layer of alcohol, cooled to 125-175 K, was kept for 20 hours in a vacuum maintained at 10^{-3} mmHg.

The degassed liquid was sealed under vacuum in an ampoule which was placed in the apparatus. The apparatus consisted of a manostat, a mercury compensator, and a solubility cell divided by a mercury seal. A gas pressure of 200 mmHg and the temperature were established. The foil ends of the ampoule were pierced. The gas dissolved as the liquid flowed through a series of small cups. The amount of gas dissolved was determined by the rise in mercury level in the compensator.

Some measurements were made at 400 mmHg gas pressure. The results confirmed that Henry's law was obeyed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Source not given. Purity by chromatographic method was 99.99 per cent.
2. 1-Propanol. Purified and analyzed in the All-Union Sci. Res. Inst. for Single Crystals & High-Purity Substances. Purity 99.97 weight per cent.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/\text{mmHg} = 0.01$
$\delta X_1/X_1 = 0.005$

REFERENCES:

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. 1-Butanol; $C_4H_{10}O$; 71-36-3	H. L. Clever Chemistry Department Emory University Atlanta, Georgia 30322 U.S.A.

CRITICAL EVALUATION:

The solubility of argon in 1-butanol was measured in three laboratories. Gjaldbaek and Niemann (1) report two values near 298.15 K and two values near 308.15 K. Boyer and Bircher (2,3) report solubility values at 298.15 K and 308.15 K. Komarenko and Manzhelii (4) report seven solubility values between 184.15 and 243.15 K.

Komarenko and Manzhelii measured the solubility of argon in 1-butanol at a gas partial pressure of 26.664 kPa (200 mmHg). The compiler calculated 101.325 kPa (1 atm) pressure mole fraction solubility values assuming Henry's law to be valid. The 101.325 kPa values were fitted to a three constant equation by the method of least squares. The smoothed values of the mole fraction solubility and the thermodynamics changes for the transfer of one mole of argon from the gas at a pressure of 101.325 kPa to the hypothetical unit mole fraction solution are given on the data sheet at 10 degree intervals for the 183.15 to 243.15 K temperature range. Komarenko and Manzhelii used an ultra high purity dry 1-butanol sample.

The room temperature region solubility values of Gjaldbaek and Niemann and of Boyer and Bircher are in conflict. They differ by 2.3 percent at 298.15 K and by 4.6 percent at 308.15 K with the Boyer and Bircher values being the higher at both temperatures.

The Boyer and Bircher solubilities increase with temperature. The Gjaldbaek and Niemann solubilities decrease with temperature. Both authors dried and distilled the alcohol. There is no evidence that the purity and dryness of the alcohol was an important factor. It is the judgment of the Evaluator that Gjaldbaek and Niemann used a more reliable method of solubility determination, and their solubility values are preferred. Smoothed data for the Gjaldbaek and Niemann appears on their data sheet.

The combination of the low temperature solubility values of Komarenko and Manzhelii with the 298.15 - 308.15 values of Gjaldbaek and Niemann gives a tentative set of solubility values for the 125 degree interval from 183.15 to 308.15 K.

The argon in 1-butanol mole fraction solubility at 101.325 kPa was fitted to the equation:

$$\ln X_1 = -11.1689 + 7.43153/(T/100) + 1.53183 \ln(T/100)$$

by the method of least squares. The standard error about the regression line was 2.06×10^{-3}.

Smoothed tentative mole fraction solubility values and values of the thermodynamic changes for the transfer of one mole fo argon from the gas at 101.325 kPa to the hypothetical unit mole fraction solution are given in Table I.

1. Gjaldbaek, J. C.; Niemann, H. Acta Chem. Scand. 1958, 12, 1015.
2. Boyer, F. L.; Bircher, L. J. J. Phys. Chem. 1960, 64, 1330.
3. Boyer, F. L. Ph.D. Thesis, Vanderbilt University, 1959.

4. Komarenko, V. G.; Manzhelii, V. G. Ukr. Fiz. Zh. (Ukr. Ed.) 1968, 13, 387.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1-Butanol; $C_4H_{10}O$; 71-36-3

EVALUATOR:

H. L. Clever
Chemistry Department
Emory University
Atlanta, Georgia 30322
U.S.A.

September 1978

CRITICAL EVALUATION:

TABLE 1. Solubility of argon in 1-butanol. Tentative mole fraction solubility at 101.325 kPa and values of changes in Gibbs energy, enthalpy, entropy, and heat capacity as a function of temperature.

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/kJ\ mol^{-1}$	$\Delta H°/kJ\ mol^{-1}$	$\Delta S°/JK^{-1}mol^{-1}$	$\Delta C_p°/JK^{-1}mol^{-1}$
183.15	2.06	9.417	-3.846	-72.42	12.74
193.15	1.81	10.138	-3.719	-71.74	12.74
203.15	1.62	10.852	-3.591	-71.10	12.74
213.15	1.47	11.560	-3.464	-70.49	12.74
223.15	1.35	12.262	-3.337	-69.90	12.74
233.15	1.25	12.958	-3.209	-69.34	12.74
243.15	1.17	13.649	-3.082	-68.81	12.74
253.15	1.10	14.335	-2.955	-68.30	12.74
263.15	1.05	15.015	-2.827	-67.80	12.74
273.15	0.999	15.691	-2.700	-67.33	12.74
283.15	0.959	16.362	-2.573	-66.87	12.74
293.15	0.924	17.028	-2.445	-66.43	12.74
298.15	0.909	17.360	-2.382	-66.21	12.74
303.15	0.895	17.690	-2.318	-66.00	12.74
308.15	0.882	18.020	-2.254	-65.79	12.74

See page 285 for high pressure data on the system (5).

The solubility value of Krestov and Slyusar (6) converts to a mole fraction solubility of 0.880 x 10^{-3} at 298.15 K and 101.325 kPa argon pressure, which is 3.2 per cent lower than the value calculated from the tentative equation. It is 2.4 per cent lower than Gjaldbaek and Niemann's value.

5. Sisskind, B.; Kasarnowsky, I. Z. Anorg. Chem. 1933, 214, 385.

6. Krestov, G. A.; Slyusar, V. P. Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1978, 21, 1294.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1-Butanol; $C_4H_{10}O$; 71-36-3

ORIGINAL MEASUREMENTS:

Gjaldbaek, J. C.; Niemann, H.

Acta Chem. Scand. 1958, 12, 1015-1023

VARIABLES:

T/K: 298.15 - 308.15

PREPARED BY:

J. Chr. Gjaldbaek

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α*	Ostwald Coefficient L
298.14	0.904	0.2206	0.2408
298.15	0.901	0.2198	0.2399
308.13	0.892	0.2156	0.2432
308.15	0.888	0.2146	0.2421

Smoothed Data: $\Delta G° = - RT \ln X_1 = -1,066.4 + 61.863\ T$

Std. Dev. $\Delta G° = 5.7$, Coef. Corr. = 0.9999

$\Delta H°/J\ mol^{-1} = 1,066.4$, $\Delta S°/J\ K^{-1}\ mol^{-1} = -61.863$

The Ostwald coefficients and mole fractions were calculated by the compiler.

Values at 1 atmosphere pressure assuming Henry's law is obeyed.

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/J\ mol^{-1}$
293.15	0.909	17,068
298.15	0.903	17,377
303.15	0.896	17,687
308.15	0.890	17,996

AUXILIARY INFORMATION

METHOD:

A calibrated all-glass combined manometer and bulb was enclosed in an air thermostat and shaken until equilibrium. Mercury was used for calibration and as confining liquid. The solvents were degassed in the apparatus. Details in ref. 1 and 2.

APPARATUS/PROCEDURE:

The absorbed volume of gas is calculated from the initial and final amounts, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury. Details in ref. 1 and 2.

SOURCE AND PURITY OF MATERIALS:

1. Argon. "L" air liquid. Dried. < 0.05 % H_2O.
2. 1-Butanol. Distilled, b.p. 117.75 - 117.83°C. n(D, 293.15 K) = 1.3995.

ESTIMATED ERROR:

$\delta T/K = 0.05$

$\delta X_1/X_1 = 0.015$

REFERENCES:

1. Lannung, A. J. Am. Chem. Soc. 1930, 52, 68.
2. Gjaldbaek, J. C. Acta Chem. Scand. 1952, 6, 623.

COMPONENTS:

1. Argon; Ar; 71-23-8
2. 1-Butanol; $C_4H_{10}O$; 71-36-3

ORIGINAL MEASUREMENTS:

Boyer, F. L.; Bircher, L. J.

J. Phys. Chem. 1960, 64, 1330-1331.

VARIABLES:

T/K: 298.15 - 308.15

PREPARED BY:

M. E. Derrick

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	0.931	0.225	0.246 ± 0.001
308.15	0.922	0.225	0.254 ± 0.006

The Bunsen Coefficient was calculated by the compiler.

The 308.15 K values are from Boyer (2). The mole fraction solubility at 298.15 K is also from Boyer (2). The value in the original paper of 0.923 x 10^{-3} was calculated from the authors equation:

$$\log X_1 = -3.381 + 0.573 \log C$$

where C is the number of carbons in the alcohol. At a temperature of 308.15 K the equation is

$$\log X_1 = -3.392 + 0.599 \log C.$$

AUXILIARY INFORMATION

METHOD:

Gas extracted from solvent followed by measurement of gas and solvent volumes (1).

SOURCE AND PURITY OF MATERIALS:

1. Argon. Ohio Surgical Co. 99.6 per cent.
2. 1-Butanol. Removed aldehydes and ketones, dried, and distilled by standard methods.

APPARATUS/PROCEDURE:

Modified E. H. Sargent Co. manometric Van Slyke blood gas apparatus used. Total pressure of gas and vapor in solution chamber adjusted to atmospheric pressure. Solvent transferred to bulb below extraction vessel and sealed off. Gas and solvent vapors brought to volume over mercury (1).

ESTIMATED ERROR:

$\delta T/K = 0.01$

$\delta L/L = 0.002$

REFERENCES:

1. Peters, J. P.; Van Slyke, D. D. "Qualitative Clinical Chemistry", Williams and Wilkins Co., Baltimore, Md., 1932, Vol. II.
2. Boyer, F. L., Ph.D. Dissertation, Vanderbilt Univ., Nashville, Tn.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1-Butanol; $C_4H_{10}O$; 71-36-3

ORIGINAL MEASUREMENTS:

Komarenko, V.G.; Manzhelii, V.G.

<u>Ukr.Fiz.Zh.</u> (<u>Ukr.Ed.</u>) 1968, <u>13</u>, 387-391.
<u>Ukr. Phys. J.</u> 1968, <u>13</u>, 273-276.

VARIABLES:

T/K: 184.15 - 243.15
P/kPa: 26.664 (200 mmHg)

PREPARED BY:

T.D. Kittredge

EXPERIMENTAL VALUES:

T/K	Mol Fraction P/mmHg 200 $X_1 \times 10^3$	Mol Fraction P/mmHg 760 $X_1 \times 10^3$
184.15	0.530	2.01
193.15	0.478	1.82
203.15	0.425	1.62
213.15	0.392	1.49
223.15	0.360	1.37
233.15	0.332	1.26
243.15	0.297	1.13

Smoothed Data: $\ln X_1 = -4.90674 - 0.0908805/(T/100) - 2.05985/\ln(T/100)$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^o/kJmol^{-1}$	$\Delta H^o/kJmol^{-1}$	$\Delta S^o/JK^{-1}mol^{-1}$	$\Delta C^o p/JK^{-1}mol^{-1}$
183.15	2.02	9.446	-3.061	-68.29	-17.13
193.15	1.82	10.133	-3.232	-69.20	"
203.15	1.64	10.83	-3.404	-70.06	"
213.15	1.49	11.53	-3.575	-70.88	"
223.15	1.36	12.25	-3.746	-71.67	"
233.15	1.24	12.97	-3.917	-72.42	"
243.15	1.14	13.70	-4.089	-73.14	"

The mole fraction solubility at 101.325 kPa (760 mmHg) was calculated by Henry's law by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solvent was degassed by vacuum. A thin layer of alcohol, cooled to 125-175 K, was kept for 20 hours in a vacuum maintained at 10^{-3} mmHg.

The degassed liquid was sealed under vacuum in an ampoule which was placed in the apparatus. The apparatus consisted of a manostat, a mercury compensator, and a solubility cell divided by a mercury seal. A gas pressure of 200 mmHg and the temperature were established. The foil ends of the ampoule were pierced. The gas dissolved as the liquid flowed through a series of small cups. The amount of gas dissolved was determined by the rise in mercury level in the compensator.

Some measurements were made at 400 mmHg gas pressure. The results confirmed that Henry's law was obeyed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Source not given. Purity by chromatographic method was 99.99 per cent.
2. 1-Butanol. Purified and analyzed in the All-Union Sci. Res. Inst. for Single Crystals & High-Purity Substances. Purity 99.97 weight per cent.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/mmHg = 0.01$
$\delta X_1/X_1 = 0.005$

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Butanols

ORIGINAL MEASUREMENTS:

Krestov, G. A.; Slyusar, V. P.

Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1978, 21, 1294 - 1297.

VARIABLES:

T/K: 298.15
P/kPa: 101.325 (760 mmHg)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Butanol $cm^3\ mol^{-1}$ at 298.15 K	Argon Solubility	
		cm^3 Ar (298.15 K, 760 mmHg) (mol butanol)$^{-1}$	Ostwald/L
	1-Butanol; C_4H_9OH; 71-36-3		
298.15	91.98	21.54	0.2342
	2-Butanol or sec-Butanol; C_4H_9OH; 78-92-2		
298.15	92.35	22.66	0.2454
	2-Methyl-1-Propanol or Isobutanol; C_4H_9OH; 78-83-1		
298.15	92.78	22.94	0.2470
	2-Methyl-2-Propanol or t-Butanol; C_4H_9OH; 75-65-0		
298.15	94.92	26.41	0.2782

The compiler calculated the Ostwald coefficients by dividing the cm^3 Ar at 298.15 K and 760 mmHg (mol butanol)$^{-1}$ by the butanol molar volume at 298.15 K.

The argon Bunsen coefficient in 2-methyl-2-propanol at temperatures of 298.15, 303.15, 308.15 and 313.15 was shown on a small graph in an earlier paper from the same laboratory (1).

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

The apparatus is a modification of the apparatus of Ben-Naim and Baer (2). Modifications include a degassing vessel connected directly to the absorption cell, a bubbling vessel to presaturate the gas with solvent vapor, and means to maintain the gas supply at a constant pressure The entire apparatus is immersed in a 400 liter water bath controlled to within 0.005 K (3, 4).

The solvent is degassed by boiling four hours under vacuum. Degassed solvent is admitted to the 639 ml absorption vessel. Gas,presaturated with solvent vapor,is admitted. After 30 minutes rapid stirring 98 % of the gas is dissolved. Slow stirring is continued for 2 hours to insure equilibrium.

3. Nedel'ko, B. E.;Krestov, G. A. Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1969, 12, 998.
4. Patsatsiya, K. M.; Krestov, G. A. Zh. Fiz. Khim. 1970, 44, 1835.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially pure grade designated MRTU-6-02-377-66. Contained not more than 0.015 per cent impurities.
2. Butanols. Chemically pure.

ESTIMATED ERROR:

$\delta T/K = 0.005$
$\delta \gamma/\gamma = 0.01$ (Compiler)

REFERENCES:

1. Krestov, G. A.; Nedel'ko, B. E.; Slyusar, V. P. Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1976, 19, 1629.
2. Ben-Naim, A.; Baer, S. Trans.Faraday Soc. 1963, 59, 2735.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. 2-Methyl-1-propanol or Isobutanol; C_4H_9OH; 78-83-1

ORIGINAL MEASUREMENTS:

Battino, R.; Evans, F. D.; Danforth, W. F.; Wilhelm, E.

J. Chem. Thermodyn. 1971, 3, 743 - 751.

VARIABLES:

T/K: 274.07 - 327.95
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
274.07	1.026	0.224	0.225
282.88	0.984	0.241	0.250
282.88	1.013	0.248	0.257
282.94	0.963	0.236	0.244
295.77	0.981	0.237	0.257
298.37	0.944	0.227	0.249
308.34	0.935	0.223	0.252
312.73	0.915	0.217	0.249
327.95	0.881	0.207	0.248

The Bunsen coefficients were calculated by the compiler.
The solubility values were adjusted to an argon partial pressure of 101.325 kPa (1 atm) by Henry's law.

Smoothed Data: $\Delta G^\circ/\mathrm{J\ mol^{-1}} = -RT \ln X_1 = -1964.2 + 64.431\ T$

Std. Dev. $\Delta G^\circ = 39.6$, Coef. Corr. = 0.9994

$\Delta H^\circ/\mathrm{J\ mol^{-1}} = -1964.2$, $\Delta S^\circ/\mathrm{J\ K^{-1}\ mol^{-1}} = -64.431$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^\circ/\mathrm{J\ mol^{-1}}$
273.15	1.024	15,635
278.15	1.008	15,957
288.15	0.978	16,601
298.15	0.952	17,246
308.15	0.928	17,890
318.15	0.906	18,534
328.15	0.885	19,179

See page 169 for evaluation comments on the system.

METHOD/APPARATUS/PROCEDURE:

The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co. Inc. 99.995 per cent.
2. 2-Methyl-1-propanol. Fisher Co. Certified grade (99 mole per cent).

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.005$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. J. Am. Oil Chem. Soc. 1968, 45, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. Anal. Chem. 1971, 43, 806.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. 1-Pentanol; $C_5H_{11}OH$; 71-41-0

ORIGINAL MEASUREMENTS:

Gjaldbaek, J. C.; Niemann, H.

Acta Chem. Scand. 1958, 12, 1015-1023.

VARIABLES:

T/K: 298.12 - 308.18
P/kPa: 101.325 (1 atm)

PREPARED BY:

J. Chr. Gjaldbaek

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.12	0.995	0.2055	0.2243
298.15	0.992	0.2049	0.2237
308.18	0.990	0.2025	0.2285
308.16	0.972	0.1993	0.2248

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -965.83 + 60.73\ T$

Std. Dev. $\Delta G° = 19.5$, Coef. Corr. = 0.9985

$\Delta H°/J\ mol^{-1} = -965.83$, $\Delta S°/J\ K^{-1}\ mol^{-1} = -60.73$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/J\ mol^{-1}$
293.15	1.000	16,836
298.15	0.993	17,140
303.15	0.987	17,444
308.15	0.981	17,447
313.15	0.975	18,051

The solubility values are at 101.325 kPa (1 atm) assuming that Henry's law is obeyed.

AUXILIARY INFORMATION

METHOD:

APPARATUS/PROCEDURE: A calibrated, all-glass combined manometer and bulb was enclosed in an air thermostat and shaken until equilibrium. Mercury was used for calibration and as confining liquid. The solvents were degassed in the apparatus (1,2).

The absorbed volume of gas is calculated from the initial and final amounts both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury.

SOURCE AND PURITY OF MATERIALS:

1. Argon. "L'air liquid. Dried. < 0.05 % water.
2. 1-Pentanol. Fractionated at about 115 mmHg. Boiling point 137.83 - 137.90 °C at 760 mmHg. Refractive index (Na D, 293.15 K) = 1.412.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta X_1/X_1 = 0.015$

REFERENCES:

1. Lannung, A. J. Am. Chem. Soc. 1930, 52, 68.
2. Gjaldbaek, J. C. Acta Chem. Scand. 1952, 6, 623.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1-Pentanol, $C_5H_{11}OH$; 71-41-0

ORIGINAL MEASUREMENTS:

Boyer, F. L.; Bircher, L. J.

J. Phys. Chem. 1960, 64, 1330-1331.

VARIABLES:

T/K: 298.15, 308.15

P/kPa: 101.325 (1 atm)

PREPARED BY:

M. E. Derrick

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	1.04	0.210	0.229 ± 0.008
308.15	1.05	0.216	0.244 ± 0.003

The Bunsen coefficients were calculated by the compiler.

The observed mole fraction solubilities were taken from Boyer's dissertation (2).

The Dissertation gives the equations log X_1 = -3.381 + 0.573 log C at 298.15 K and log X_1 = -3.392 + 0.599 log C at 308.15 K where C is the number of carbon atoms in the alcohol. The mole fraction solubility given in the original paper was calculated from the 298.15 K equation.

Smoothed Data: $\Delta G^0 = -RT \ln X_1 = -340.5 + 58.25\ T$

The equation is tentative.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Commercial Van Slyke blood gas apparatus (E. H. Sargent Co.) was modified by the authors for their use.

The total pressure of gas and solvent vapor in the solution chamber was adjusted to a pressure of one atm. The pressure was maintained at one atm during the solution process. The saturated solution was transferred to a bulb below the lower stopcock of the extraction vessel and sealed off. The gas and solvent vapor were then brought to volume over mercury. See (1) for details of the extraction procedure.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Ohio Surgical Co. 99.6 per cent argon.
2. 1-Pentanol. Source not given. Treated by standard methods to remove aldehydes and ketones, then dried and distilled.

ESTIMATED ERROR:

$\delta T/K = 0.01$

$\delta L/cm^3 = 0.008$

REFERENCES:

1. Peters, J. P.; Van Slyke, D. D. "Quantitative Clinical Chemistry" Williams and Wilkins Co., Baltimore, MD, 1932, Volume II.
2. Boyer, F. L. Ph.D. Dissertation Vanderbilt U., 1959, Nashville, TN

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. 1-Hexanol; $C_6H_{13}OH$; 111-27-3

ORIGINAL MEASUREMENTS:

Boyer, F. L.; Bircher, L. J.

J. Phys. Chem. 1960, 64, 1330-1331.

VARIABLES:

T/K: 298.15

P/kPa: 101.325 (1 atm)

PREPARED BY:

M. E. Derrick

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	1.14	0.205	0.224 ± 0.001

The Bunsen coefficient was calculated by the compiler.

The observed mole fraction solubility was taken from Boyer's dissertation (2).

The Dissertation gives the equation log X_1 = -3.381 + 0.573 log C at 298.15 K where C is the number of carbon atoms in the alcohol. The mole fraction solubility given in the original paper was calculated from the 298.15 K equation.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Commercial Van Slyke blood gas apparatus (E. H. Sargent Co.) was modified by the authors for their use.

The total pressure of gas and solvent vapor in the solution chamber was adjusted to a pressure of one atm. The pressure was maintained at one atm during the solution process. The saturated solution was transferred to a bulb below the lower stopcock of the extraction vessel and sealed off. The gas and solvent vapor were then brought to volume over mercury. See (1) for details of the extraction procedure.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Ohio Surgical Co.
   99.6 per cent argon.
2. 1-Hexanol. Source not given. Treated by standard methods to remove aldehydes and ketones, then dried and distilled.

ESTIMATED ERROR:

$\delta T/K = 0.01$

$\delta L/cm^3 = 0.001$

REFERENCES:

1. Peters, J. P.; Van Slyke, D. D. "Quantitative Clinical Chemistry" Williams and Wilkins Co., Baltimore, MD, 1932, Volume II.
2. Boyer, F. L. Ph.D. Dissertation Vanderbilt U., 1959, Nashville, TN

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1-Heptanol; $C_7H_{15}OH$; 111-70-6

ORIGINAL MEASUREMENTS:

Boyer, F. L.; Bircher, L. J.

J. Phys. Chem. 1960, 64, 1330-1331.

VARIABLES:

T/K: 298.15

P/kPa: 101.325 (1 atm)

PREPARED BY:

M. E. Derrick

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	1.25	0.200	0.218 ± 0.003

The Bunsen coefficient was calculated by the compiler.

The observed mole fraction solubility was taken from Boyer's dissertation (2).

The Dissertation gives the equation $\log X_1 = -3.381 + 0.573 \log C$ at

298.15 K where C is the number of carbon atoms in the alcohol. The mole fraction solubility given in the original paper was calculated from the 298.15 K equation.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Commerical Van Slyke blood gas apparatus (E. H. Sargent Co.) was modified by the authors for their use.

The total pressure of gas and solvent vapor in the solution chamber was adjusted to a pressure of one atm. The pressure was maintained at one atm during the solution process. The saturated solution was transferred to a bulb below the lower stopcock of the extraction vessel and sealed off. The gas and solvent vapor were then brought to volume over mercury. See (1) for details of the extraction procedure.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Ohio Surgical Co. 99.6 per cent argon.
2. 1-Heptanol. Source not given. Treated by standard methods to remove aldehydes and ketones, then dried and distilled.

ESTIMATED ERROR:

$\delta T/K = 0.01$

$\delta L/cm^3 = 0.003$

REFERENCES:

1. Peters, J. P.; Van Slyke, D. D. "Quantitative Clinical Chemistry" Williams and Wilkins Co., Baltimore, MD, 1932, Volume II.
2. Boyer, F. L. Ph.D. Dissertation Vanderbilt U., 1959, Nashville, TN

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1-Octanol; $C_8H_{17}OH$; 111-87-5

ORIGINAL MEASUREMENTS:

Boyer, F. L.; Bircher, L. J.

J. Phys. Chem. 1960, 64, 1330-1331.

VARIABLES:

T/K: 298.15, 308.15

P/kPa: 101.325 (1 atm)

PREPARED BY:

M. E. Derrick

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	1.38	0.195	0.213 ± 0.005
308.15	1.40	0.192	0.217 ∓ 0.008

The Bunsen coefficients were calculated by the compiler.

The observed mole fraction solubilities were taken from Boyer's dissertation (2).

The Dissertation gives the equations $\log X_1 = -3.381 + 0.573 \log C$ at 298.15 K and $\log X_1 = -3.392 + 0.599 \log C$ at 308.15 K where C is the number of carbon atoms in the alcohol. The mole fraction solubility given in the original paper was calculated from the 298.15 K equation.

Smoothed Data: $\Delta G^0/J\ mol^{-1} = -RT \ln X_1 = 1089.5 + 51.1\ T$

The equation is tentative.

See pages 169 - 170 for Evaluator's comments.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Commercial Van Slyke blood gas apparatus (E. H. Sargent Co.) was modified by the authors for their use.

The total pressure of gas and solvent vapor in the solution chamber was adjusted to a pressure of one atm. The pressure was maintained at one atm during the solution process. The saturated solution was transferred to a bulb below the lower stopcock of the extraction vessel and sealed off. The gas and solvent vapor were then brought to volume over mercury. See (1) for details of the extraction procedure.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Ohio Surgical Co. 99.6 per cent argon.
2. 1-Octanol. Source not given. Treated by standard methods to remove aldehydes and ketones, then dried and distilled.

ESTIMATED ERROR:

$\delta T/K = 0.01$

$\delta L/cm^3 = 0.008$

REFERENCES:

1. Peters, J. P.; Van Slyke, D. D. "Quantitative Clinical Chemistry" Williams and Wilkins Co., Baltimore, MD, 1932, Volume II.
2. Boyer, F. L. Ph.D. Dissertation Vanderbilt U., 1959, Nashville, TN

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1-Octanol; $C_8H_{17}OH$; 111-87-5

ORIGINAL MEASUREMENTS:

Wilcock, R. J.; Battino, R.; Danforth, W. F.; Wilhelm, E.

J. Chem. Thermodyn. 1978, *10*, 817-822.

VARIABLES:

T/K: 283.28 - 313.57

P/kPa: 101.325

PREPARED BY:

A. L. Cramer
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
283.28	1.271	0.1822	0.1890
298.10	1.273	0.1818	0.1968
313.57	1.237	0.1728	0.1984

The Bunsen coefficients were calculated by the compiler.

The solubility values were adjusted to an argon partial pressure of 101.325 kPa (1 atm) by Henry's law.

Smoothed Data: $\Delta G^o/J\ mol^{-1} = -RT \ln X_1 = -679.6 + 57.793\ T$

Std. Dev. $\Delta G^o = 7.7$, Coef. Corr. = 0.9999

$\Delta H^o/J\ mol^{-1} = -679.6$, $\Delta S^o/J\ K^{-1}\ mol^{-1} = -57.793$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^o/J\ mol^{-1}$
278.15	1.28	15,396
288.15	1.27	15,973
298.15	1.26	16,551
308.15	1.25	17,129
318.15	1.24	17,707

See pages 169 - 170 for Evaluator's comments.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Inc. 99.995 per cent.
2. 1-octanol. Eastman Organic Chemicals. Distilled, density $\rho_{298.15} = 0.8247\ g\ cm^{-3}$

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.01$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1-Decanol; $C_{10}H_{21}OH$; 112-30-1

ORIGINAL MEASUREMENTS:

Wilcock, R. J.; Battino, R.
Danforth, W. F.; Wilhelm, E.

J. Chem. Thermodyn. 1978, 10, 817-822.

VARIABLES:

T/K: 282.60 - 313.54
P/kPa: 101.325 (1 atm)

PREPARED BY:

A. L. Cramer
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
282.60	1.474	0.1748	0.1808
298.10	1.494	0.1750	0.1910
313.54	1.441	0.1666	0.1912

The Bunsen coefficients were calculated by the compiler.

The solubility values were adjusted to an argon partial pressure of 101.325 kPa (1 atm) by Henry's law.

Smoothed Data: $\Delta G^o/J\ mol^{-1} = -RT \ln X_1 = -557.4 + 56.106\ T$

Std. Dev. $\Delta G^o = 12.1$, Coef. Corr. = 0.9998

$\Delta H^o/J\ mol^{-1} = -557.4$, $\Delta S^o/J\ K^{-1}\ mol^{-1} = -56.106$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^o/J\ mol^{-1}$
278.15	1.49	15,048
288.15	1.48	15,610
298.15	1.47	16,171
308.15	1.46	16,732
318.15	1.45	17,293

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Inc. 99.995 per cent Ar.
2. 1-Decanol. Eastman Organic Chemicals. Distilled, density $\rho_{298.15} = 0.8206\ g\ cm^{-3}$.

ESTIMATED ERROR:

$\delta T/K = 0.02$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.01$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. J. Am. Oil Chem. Soc. 1968, 45, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. Anal. Chem. 1971, 43, 806.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1,2-Ethanediol or Ethylene glycol; $(CH_2OH)_2$; 107-21-1

ORIGINAL MEASUREMENTS:

Gjaldbaek, J. C.; Niemann, H.

Acta Chem. Scand. 1958, 12, 1015-1023.

VARIABLES:

T/K: 298.14 - 308.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

J. Chr. Gjaldbaek

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.14	0.0798	0.0320	0.0349
298.14	0.0783	0.0314	0.0343
308.15	0.0815	0.0325	0.0367
308.15	0.0791	0.0315	0.0355

Smoothed Data: $\Delta G^0/\text{J mol}^{-1} = -RT \ln X_1 = 1192.1 + 74.534\ T$

Std. dev. $\Delta G^0 = 36.7$, Coef. corr. = 0.9964

$\Delta H^0/\text{J mol}^{-1} = 1192.1$, $\Delta S^0/\text{J K}^{-1}\text{ mol}^{-1} = -74.845$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^0/\text{J mol}^{-1}$
293.15	0.0784	23,042
298.15	0.0790	23,414
303.15	0.0797	23,787
308.15	0.0803	24,160

The Ostwald and mole fraction solubility values were calculated by the compiler.

The Editor and his staff added the smoothed data.

AUXILIARY INFORMATION

METHOD:

APPARATUS/PROCEDURE: A calibrated all-glass combined manometer and bulb was enclosed in an air thermostat and shaken until equilibrium. Mercury was used for calibration and as the confining liquid. The solvents were degassed in the apparatus. Details are in references 1 and 2.

The absorbed volume of gas is calculated from the initial and final amounts, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury.

SOURCE AND PURITY OF MATERIALS:

1. Argon. "L'air Liquid". Dried, less than 0.05 per cent water.
2. 1,2-Ethanediol. Fractionated in a column at about 53 mmHg. Boiling point 197.30-197.42 °C at 760 mmHg, refractive index $n_D = 1.4320$ at 20 °C.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta X_1/X_1 = 0.015$

REFERENCES:

1. Lannung, A.
J. Am. Chem. Soc. 1930, 52, 68.
2. Gjaldbaek, J. C.
Acta Chem. Scand. 1952, 6, 623.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1,2-Ethanediol or Ethylene Glycol; $C_2H_6O_2$; 107-21-1

ORIGINAL MEASUREMENTS:

Ben-Naim, A.

J. Phys. Chem. 1968, 72, 2998 - 3001.

VARIABLES:

T/K: 288.15 - 307.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
288.15	0.0845	0.0341	0.0360
293.15	0.0846	0.0340	0.0365
298.15	0.0848	0.0340	0.0371
301.15	0.0847	0.0339	0.0374
304.15	0.0849	0.0339	0.0377
307.15	0.0843	0.0336	0.0378

The Ostwald coefficients were read from a graph in the original paper by the compiler. The mole fraction solubility and the Bunsen coefficient values were calculated by the compiler.

Smoothed Data: $\Delta G^0/J\ mol^{-1} = -RT \ln X_1 = 20.3 + 77.898\ T$

Std. Dev. $\Delta G^0 = 3.8$, Coef. Corr. = 0.9999

$\Delta H^0/J\ mol^{-1} = 20.3$, $\Delta S^0/J\ K^{-1}\ mol^{-1} = -77.898$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^0/J\ mol^{-1}$
288.15	0.0846	22,467
298.15	0.0846	23,246
308.15	0.0846	24,025

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A calibrated dissolution vessel contains degassed ethanediol. Gas is introduced wet from a calibrated gas buret system. Stirring the liquid forces it up to sidearms attached to the top of the flask and the liquid returns via a central tube. The amount of gas dissolved is determined by the gas burets. The entire apparatus is thermostated in a water bath. 97 % of the gas dissolves in 30 min., the remainder in 4 hours of slow stirring (1).

SOURCE AND PURITY OF MATERIALS:

1. Argon. No information given.
2. 1,2-Ethanediol. Fluka's Pure Grade or Analar Grade. The first was used in most of the measurements.

ESTIMATED ERROR:

$\delta L/L = 0.002$

For the apparatus, taking the value from a graph adds uncertainty.

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Cyclohexanol; $C_6H_{11}OH$; 108-93-0

ORIGINAL MEASUREMENTS:

Lannung, A.

J. Am. Chem. Soc. 1930, *52*, 68 - 80.

VARIABLES:

T/K: 298.15 - 318.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	0.534	0.113	0.123
298.15	0.529	0.112	0.122
298.15	0.529	0.112	0.122
310.15	0.549	0.115	0.131
310.15	0.544	0.114	0.129
310.15	0.539	0.113	0.128
318.15	0.562	0.117	0.136
318.15	0.557	0.116	0.135
318.15	0.548	0.114	0.133

The mole fraction solubility and Ostwald coefficent values were calculated by the compiler.

Smoothed Data: $\Delta G^0/J\ mol^{-1} = -RT \ln X_1 = 1798.2 + 56.678\ T$

Std. Dev. ΔG^0 = 22.2, Coef. corr. = 0.9989

$\Delta H^0/J\ mol^{-1} = 1798.2$, $\Delta S^0/J\ K^{-1}\ mol^{-1} = -56.678$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^0/J\ mol^{-1}$
298.15	0.530	18,697
308.15	0.543	19,264
318.15	0.555	19,830

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus is a modification of that of von Antropoff (1). A calibrated, combined all glass manometer and absorption bulb is enclosed in an air thermostat. Mercury is used as the calibration and confining liquid. The solvent is degassed in the apparatus. The solvent and gas (presaturated with solvent vapor) are shaken together until equilibrium is established.

EVALUATOR'S NOTE:

Cauquil (2) reported an Ostwald coefficient of 0.173 at 299.15 K and a total pressure of 755 mmHg. The value is rejected as probably high.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Linde's Liquid Air Factory. Contained 0.5 per cent by volume nitrogen.
2. Cyclohexanol. Poulenc Frères "pur". Fractionated twice *in vacuo*, portion used melted 23.6 - 23.9 °C.

ESTIMATED ERROR:

$\delta T/K = 0.03$

REFERENCES:

1. von Antropoff, A. *Z. Electrochem.* 1919, *25*, 269.
2. Cauquil, G. *J. Chim. Phys.* 1927, *68*, 53.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. 1,4-Dioxane; $C_4H_8O_2$; 123-91-1

ORIGINAL MEASUREMENTS:

Ben-Naim, A.; Moran, G.

Trans. Faraday Soc. 1965, 61, 821 - 825.

VARIABLES:

T/K: 288.15 - 298.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
288.15	0.583	0.154	0.162
293.15	0.593	0.156	0.167
298.15	0.604	0.158	0.172

The Ostwald coefficents were read from a graph in the original paper by the compiler. The Bunsen coefficient and the mole fraction solubility values were calculated by the compiler for an argon partial pressure of 101.325 kPa (1 atm) assuming the Ostwald coefficient to be independent of pressure.

Smoothed Data: $\Delta G^0/\text{J mol}^{-1} = -RT \ln X_1 = 2513.1 + 53.200\ T$

$\Delta H^0/\text{J mol}^{-1} = 2513.1$, $\Delta S^0/\text{J K}^{-1}\text{ mol}^{-1} = -53.200$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^0/\text{J mol}^{-1}$
288.15	0.583	17,843
298.15	0.604	18,375

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A calibrated dissolution vessel contains degassed dioxane. Gas is introduced wet from a calibrated gas buret system. Stirring the liquid forces it up through sidearms attached to the top of the flask and the liquid returns via a central tube The amount of gas dissolved is determined in the gas burets. The entire apparatus is thermostated in a water bath. 97 per cent of the gas dissolves in the first 30 minutes, the remainder in four hours of slow stirring (1).

SOURCE AND PURITY OF MATERIALS:

1. Argon. No information.

2. 1,4-Dioxane. Source not given. Refluxed over KOH + Ag_2O for 48 hours, distilled.

ESTIMATED ERROR:

$\delta L/L = 0.002$ for the overall measurement. Reading the value from a graph adds uncertainty.

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 2-Propanone or Acetone; C_3H_6O; 67-64-1

ORIGINAL MEASUREMENTS:

Lannung, A.

J. Am. Chem. Soc. 1930, *52*, 68 - 80.

VARIABLES:

T/K: 278.15 - 313.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

P. L. Long
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
278.15	0.859	0.268	0.273
279.15	0.864	0.269	0.275
283.15	0.871	0.270	0.280
287.15	0.879	0.271	0.285
286.15	0.878	0.271	0.284
291.15	0.887	0.272	0.290
291.15	0.887	0.272	0.290
293.15	0.890	0.272	0.292
298.15	0.903	0.274	0.299
298.15	0.903	0.274	0.299
298.15	0.903	0.274	0.299
308.15	0.929	0.278	0.314
308.15	0.929	0.278	0.314
310.15	0.934	0.279	0.317
313.15	0.945	0.281	0.322

The mole fraction and ostwald solubilities were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = 1903.7 + 51.872\ T$

Std. Dev. $\Delta G° = 7.4$, Coef. Corr. = 0.9999

$\Delta H°/J\ mol^{-1} = 1903.7$, $\Delta S°/J\ K^{-1}\ mol^{-1} = -51.872$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/J\ mol^{-1}$
278.15	0.857	16,332
288.15	0.882	16,851
298.15	0.906	17,369
308.15	0.929	17,888

AUXILIARY INFORMATION

METHOD:

Gas absorption. The gas is presaturated with solvent vapor. The gas volume absorbed is the difference between initial and final gas volumes. The amount of solvent is determined by the weight of mercury displaced.

APPARATUS/PROCEDURE:

The apparatus is a modification of that of von Antropoff (1). A calibrated, combined all glass manometer and bulb is enclosed in an air thermostat. Mercury is used as the calibration and confining liquid. The solvent is degassed in the apparatus. The solvent and the gas are shaken together until equilibrium is established.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Linde's Liquid Air Factory. Contained 0.5 percent by volume nitrogen.
2. 2-Propanone. Kahlbaum's "zur Analyse". Used after tests showed absence of water, acid and aldehyde.

ESTIMATED ERROR:

$\delta T/K = 0.03$

REFERENCES:

1. v. Antropoff, A.
Z. Electrochem. 1919, *25*, 269.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Acetic Acid; CH_3COOH; 64-19-7

ORIGINAL MEASUREMENTS:

Krestov, G. A.; Nedel'ko, B. E.

Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1975, 18, 1893 - 1896.

VARIABLES:

T/K: 288.15 - 323.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
288.15	0.440	0.1727	0.1822
298.15	0.418	0.1630	0.1779
308.15	0.396	0.1527	0.1724
323.15	0.357	0.1355	0.1604

Solubility values were adjusted to an argon partial pressure of 101.325 kPa by Henry's law.

The mole fraction solubities were calculated by the compiler.

Smoothed Data: $\Delta G^0/J\ mol^{-1} = -RT \ln X_1 = -4655.9 + 80.342\ T$

Std. Dev. $\Delta G^0 = 7.4$, Coef. corr. 0.9998

$\Delta H^0/J\ mol^{-1} = -4655.9$, $\Delta S^0/J\ K^{-1}\ mol^{-1} = -80.342$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^0/J\ mol^{-1}$
288.15	0.444	18,495
298.15	0.416	19,298
308.15	0.391	20,102
318.15	0.370	20,905
328.15	0.350	21,708

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE: The apparatus is a modification of the apparatus of Ben-Naim and Baer (1). Modifications include a degassing vessel connected directly to the absorption cell, a bubbling vessel to presaturate the gas with solvent vapor, and means to maintain the gas supply at a constant pressure. The entire apparatus is immersed in a 400 liter water bath controlled to within 0.005 K (2, 3).

The solvent is degassed by boiling four hours under vacuum. Degassed solvent is admitted to the 639 ml absorption cell. Gas, presaturated with solvent vapor, is admitted. After 30 minutes rapid stirring 98 % of the gas is dissolved. Slow stirring is continued for 2 hours to insure equilibrium.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially pure grade designated MRTU-6-02-377-66. Contained not more than 0.004 % N_2 and 0.001 % O_2.
2. Water. Doubly distilled.
3. Acetic acid.

ESTIMATED ERROR:

$\delta T/K = 0.005$
$\delta X_1/X_1 = 0.01$

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.
2. Nedel'ko, B. E.; Krestov, G. A. Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1969, 12, 998.
3. Patsatsiya, K. M.; Krestov, G. A. Zh. Fiz. Khim. 1970, 44, 1835.

COMPONENTS:

1. Argon; Ar; 7740-37-1

2. Butanoic Acid; $C_4H_8O_2$; 107-92-6

ORIGINAL MEASUREMENTS:

Zheleznyak, N. I.; Krestov, G. A.

Zh. Strukt. Khim. 1978, 19, 818 - 823.
J. Struct. Chem. 1978, 19, 704 - 709.

VARIABLES:

T/K: 288.15 - 323.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L	Solvomolality* $C_{sm} \times 10^3$
288.15	0.8838	0.217	0.229	49.06
298.15	0.8843	0.214	0.234	49.09
308.15	0.8721	0.209	0.236	48.41
323.15	0.8559	0.202	0.239	47.57

*(mol Ar at 760 mmHg) $(55.51 \text{ mol butanoic acid})^{-1}$

The mole fraction solubility, Bunsen coefficient and Ostwald coefficient values were calculated by the compiler.

Smoothed Data: $\Delta G^\circ/\text{J mol}^{-1} = -RT \ln X_1 = -765.1 + 61.073\ T$

Std. Dev. $\Delta G^\circ = 4.8$, Coef. Corr. $= 0.9999$

$\Delta H^\circ/\text{J mol}^{-1} = -765.1$, $\Delta S^\circ/\text{J K}^{-1}\text{ mol}^{-1} = -61.073$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^\circ/\text{J mol}^{-1}$
288.15	0.8884	16,833
298.15	0.8789	17,444
308.15	0.8721	18,054
318.15	0.8621	18,665
328.15	0.8545	19,276

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus is a modification of the apparatus of Ben-Naim and Baer (1). Modifications include a degassing vessel connected directly to the absorption cell, a bubbling vessel to presaturate the gas with solvent vapor, and means to maintain the gas supply at a constant pressure. The entire apparatus is immersed in a 400 liter water bath controlled to within 0.005 K (2,3).

The solvent is degassed by boiling four hours under vacuum. Degassed solvent is admitted to the 639 ml absorption cell. Gas, presaturated with solvent vapor, is admitted. After 30 minutes rapid stirring 98 % of the gas is dissolved. Slow stirring is continued for 2 hours to insure equilibrium. The mixed solvent is prepared by weight. The composition is checked after the solution process by density and refractive index measurements.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Specially pure grade designated MRTU-6-02-377-66. Contained not more than 0.004% N_2 and 0.001% O_2.

2. Butanoic Acid.

ESTIMATED ERROR:

$\delta T/K = 0.005$
$\delta \gamma/\gamma = 0.002 - 0.004$

REFERENCES:

1. Ben-Naim, A.; Baer, S. Trans. Faraday Soc. 1963, 59, 2735.
2. Nedel'ko, B. E.; Krestov, G. A. Izv. Vyssh. Uchebn. Zaved., Khim. Khim. Tekhnol. 1969, 12, 998.
3. Patsatsiya, K. M.; Krestov, G. A. Zh. Fiz. Khim. 1970, 44, 1835.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Hexadecafluoroheptane or Perfluoroheptane; C_7F_{16}; 335-57-9

ORIGINAL MEASUREMENTS:

Gjaldbaek, J. C.; Niemann, H.

Acta Chem. Scand. 1958, 12, 611 - 614.

VARIABLES:

T/K: 298.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

J. Chr. Gjaldbaek

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	5.27	0.5286	0.5770
298.15	5.26	0.5275	0.5758

The Ostwald and mole fraction solubility values were calculated by the compiler at 101.325 kPa (1 atm) argon pressure assuming Henry's law is obeyed.

AUXILIARY INFORMATION

METHOD / APPARATUS / PROCEDURE:

A calibrated all-glass combined manometer and bulb was enclosed in an air thermostat and shaken until equilibrium. Mercury was used for calibration and as the confining liquid. The solvents were degassed in the apparatus. Details are in references 1 and 2.

The absorbed volume of gas is calculated from the initial and final amounts, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury.

SOURCE AND PURITY OF MATERIALS:

1. Argon. "L'air liquid". Dried, less than 0.05 per cent water.
2. Hexadecafluoroheptane. Fractionated, purified according to the method of Glew and Reeves (3). Boiling point 82.55-82.56 at 760 mmHg, extinction coefficient 0.02 at 216 mμ.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta X_1/X_1 = 0.015$

REFERENCES:

1. Lannung, A.
   J. Am. Chem. Soc. 1930, 52, 68.
2. Gjaldbaek, J. C.
   Acta Chem. Scand. 1952, 6, 623.
3. Glew, D. N.; Reeves, L. W.
   J. Phys. Chem. 1956, 60, 615.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Undecafluoro(trifluoromethyl)-cyclohexane or Perfluoromethyl-cyclohexane; C_7F_{14}; 355-02-2

EVALUATOR:

H. L. Clever
Department of Chemistry
Emory University
Atlanta, GA 30322
USA

June 1979

CRITICAL EVALUATION:

Reeves and Hildebrand (1) reported 10 solubility values at one atmosphere pressure and temperatures between 278.09 and 307.86 K. Clever, Battino, Saylor and Gross (2) reported three values between 289.15 K and 316.25 K. Graham and Weale (3) measured the solubility as a function of pressure at 323.15 K. They extrapolated a mole fraction solubility of 4.7 x 10^{-3} at atmospheric pressure from their measurements at pressures between 76 and 329 atmospheres.

The Reeves and Hildebrand smoothed data range from 2.7 percent higher at 288 K to 3.3 percent higher at 318 K than the data of Clever et al. The single value of Graham and Weale at 323.15 K is over 8 percent higher than the value extrapolated from Reeves and Hildebrands data.

The Reeves and Hildebrand data appear to be of exceptional accuracy. Thus their data are recommended over the other data. Their values alone are used for the recommended thermodynamic values and smoothed data below.

The recommended thermodynamic values for the transfer of one mole of argon from the gas at 101.325 kPa (1 atm) to the hypothetical unit mole fraction solution are

$\Delta G^\circ/\mathrm{J\ mol^{-1}} = -RT \ln X_1 = -1909.0 + 51.139\ T$

Std. Dev. $\Delta G^\circ = 1.55$, Coeff. Corr. = 0.9999

$\Delta H^\circ/\mathrm{J\ mol^{-1}} = -1909.0$, $\Delta S^\circ/\mathrm{J\ K^{-1}\ mol^{-1}} = -51.139$

Table 1 Solubility of argon in perfluoromethylcyclohexane at an argon pressure of 101.325 kPa. Recommended mole fraction solubility and Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^\circ/\mathrm{J\ mol^{-1}}$
278.15	4.867	12,315
283.15	4.796	12,571
288.15	4.729	12,827
293.15	4.665	13,083
298.15	4.605	13,338
303.15	4.546	13,594
308.15	4.491	13,850
313.15	4.438	14,105
318.15	4.387	14,361

1. Reeves, L. W.; Hildebrand, J. H. *J. Am. Chem. Soc.* 1957, *79*, 1313.

2. Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, G. M. *J. Phys. Chem.* 1957, *61*, 1078.

3. Graham, E. B.; Weale, K. E. *Prog. Internat. Res. Thermodynamic and Transport Properties, Symposium on Thermophysical Properties*, 2nd, Princeton, *1962*, page 153.

Jolley and Hildebrand (4) report the partial molal volume of argon dissolved in perfluoromethylcyclohexane to be (51 ± 1) $\mathrm{cm^3\ mol^{-1}}$ at 298.15 K by a dilatometer measurement.

4. Jolley, J. E.; Hildebrand, J. H. *J. Am. Chem. Soc.* 1958, *80*, 1050.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Undecafluoro(trifluoromethyl)-cyclohexane or Perfluoromethylcyclohexane; C_7F_{14}; 355-02-2

ORIGINAL MEASUREMENTS:

Reeves, L. W.; Hildebrand, J. H.

J. Am. Chem. Soc. 1957, 79, 1313-1314

VARIABLES:

T/K: 278.09 - 307.86
P/kPa: 101.325 (1 atm)

PREPARED BY:

T. D. Kittredge

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
278.09	4.8709	0.574	0.584
283.06	4.7999	0.562	0.582
283.10	4.7965	0.561	0.582
288.36	4.7234	0.548	0.579
293.08	4.6625	0.537	0.577
293.17	4.6634	0.537	0.577
293.19	4.6689	0.538	0.578
298.48	4.5962	0.526	0.574
303.16	4.5470	0.517	0.573
307.86	4.4978	0.507	0.572

The Bunsen and Ostwald coefficients were calculated by the compiler.

Smoothed Data: $\Delta G^0/\text{J mol}^{-1} = -RT \ln X_1 = -1910.47 + 51.145\,T$

Std. dev. $\Delta G^0 = 1.66$, Coef. corr. = 0.9999

$\Delta H^0/\text{J mol}^{-1} = -1910.47$, $\Delta S^0/\text{J K}^{-1}\text{ mol}^{-1} = -51.145$

This is the recommended equation for the argon + undecafluoro(trifluoromethyl)cyclohexane system. See the evaluation sheet for the system for the recommended values calculated from the equation.

AUXILIARY INFORMATION

METHOD:

APPARATUS/PROCEDURE:

The apparatus is a modified version of the apparatus of Cook and Hanson (1). The gas is measured and admitted to the degassed solvent. The apparatus is shaken for five minutes. The residual gas is measured. The procedure is repeated until the residual gas volume does not change.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Linde Co. Standard grade, 99.9 per cent pure by spectroscopic analysis.
2. Undecafluoro(trifluoromethyl)-cyclohexane. Purified by Glew and Reeves (2), distilled through vacuum jacketed column at a reflux ratio of 15:1. Normal boiling point 76.14 °C., density 1.7878 g cm^{-3} at 298.15 K.

ESTIMATED ERROR:

$\delta T/K = 0.001$
$\delta X_1/X_1 = 0.001$

REFERENCES:

1. Cook, M. W.; Hanson, D. N. Rev. Sci. Instr. 1957, 28, 370.
2. Glew, D. N.; Reeves, L. W. J. Am. Chem. Soc. 1956, 60, 615.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Undecafluoro(trifluoromethyl)-cyclohexane (Perfluoromethylcyclohexane); C_7F_{14}; 355-02-2

ORIGINAL MEASUREMENTS:

Clever, H.L.; Saylor, J.H.;
Gross, P.M.

J. Phys. Chem. 1958, 62, 89-91.

VARIABLES:

T/K: 289.15 - 316.25
Total P/kPa: 101.325 (1 atm)

PREPARED BY:

P.L. Long

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
289.15	4.62	0.538	0.570
303.15	4.34	0.496	0.550
316.25	4.27	0.478	0.553

Smoothed Data: $\Delta G^o/J\ mol^{-1} = - RT \ln X_1 = -2205.8 + 52.394\ T$

Std. Dev. ΔG^o = 29.2, Coef. Corr. = 0.9994

$\Delta H^o/J\ mol^{-1} = -2205.8$, $\Delta S^o/J\ K^{-1}\ mol^{-1} = -52.394$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^o/J\ mol^{-1}$
288.15	4.60	12,891
293.15	4.53	13,153
298.15	4.46	13,415
303.15	4.40	13,677
308.15	4.34	13,939
313.15	4.28	14,201
318.15	4.22	14,463

The solubility values were adjusted to a partial pressure of argon of 101.325 kPa (1 atm) by Henry's law.

The Bunsen coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD:

Volumeteric. The apparatus (1) is a modification of that used by Morrison and Billett (2). Modifications include the addition of a spiral solvent storage tubing, a manometer for constant reference pressure, and an extra gas buret for highly soluble gases.

APPARATUS/PROCEDURE:

(a) Degassing. 700 ml of solvent is shaken and evacuated while attached to a cold trap, until no bubbles are seen; solvent is then transferred through a 1 mm capillary tubing, released as a fine mist into a continuously evacuated flask. (b) Solvent is saturated with gas as it flows through 8 mm x 180 cm of tubing attached to a gas buret. Pressure is maintained at 1 atm as the gas is absorbed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Inc. Both standard and research grades were used.
2. Perfluoromethylcyclohexane. du Pont FCS-326, shaken with concentrated H_2SO_4, washed, dried over Drierite and distilled.

   b.p. 75.95 to 76.05° at 753 mm., lit. b.p. 76.14 at 760 mm.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/mmHg = 3$
$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. J. Phys. Chem. 1957, 61, 1078.
2. Morrison, T.J.; Billett, F. J. Chem. Soc. 1948, 2033; ibid. 1952, 3819.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1,1,2-Trichloro-1,2,2-trifluoroethane or Freon 113; $CCl_2F{\cdot}CCl_2F$; 76-13-1

ORIGINAL MEASUREMENTS:

Hiraoka, H.; Hildebrand, J. H.

J. Phys. Chem. 1964, 68, 213-214.

VARIABLES:

T/K: 273.25 - 298.06
P/kPa: 101.325 (1 atm)

PREPARED BY:

M. E. Derrick
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
273.25	3.34	0.649	0.649
277.36	3.28	0.634	0.644
288.05	3.185	0.606	0.639
293.17	3.14	0.593	0.636
298.06	3.095	0.580	0.633

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -2014.6 + 54.797\ T$

Std. Dev. $\Delta G° = 4.2$, Coef. Corr. = 0.9999

$\Delta H°/J\ mol^{-1} = -2014.6$, $\Delta S°/J\ K^{-1}\ mol^{-1} = -54.797$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/J\ mol^{-1}$
273.15	3.33	12,953
278.15	3.28	13,227
283.15	3.23	13,501
288.15	3.18	13,775
293.15	3.14	14,049
298.15	3.09	14,323

AUXILIARY INFORMATION

METHOD: Saturation of degassed liquid with gas near 1 atm. Volume of gas absorbed by liquid determined by P-V measurements in a gas buret (1).

APPARATUS/PROCEDURE: Thermostated gas buret and pipet for solution and solvent reservoir used. The pipet contains a magnetic stirrer. Liquid confined in pipet by mercury. Liquid volume is the difference between volume of pipet and volume of mercury. The connection between the buret and pipet prevents gas and solvent vapor from mixing.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., passed through cold trap.
2. 1,1,2-Trichloro-1,2,2-trifluoroethane. Union Carbide Co. Distilled, purity checked by ultraviolet absorbance.

ESTIMATED ERROR:

$\delta T/K = 0.02$
$\delta X_1/X_1 = 0.003$

REFERENCES:

1. Kobatake, Y.; Hildebrand, J. H. J. Phys. Chem. 1961, 65, 331.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Benzene; C_6H_6; 71-43-2
3. 1,1,2-Trichloro-1,2,2-trifluoroethane or Freon 113; $C_2Cl_3F_3$; 76-13-1

ORIGINAL MEASUREMENTS:

Linford, R. G.; Hildebrand, J. H.

J. Phys. Chem. 1969, 73, 4410 - 4411.

VARIABLES:

T/K: 298.15
P/kPa: 101.325 (1 atm)
C_6H_6/X_2: 0.348, 0.650

PREPARED BY:

T. D. Kittredge

EXPERIMENTAL VALUES:

T/K	Benzene Mol Fraction X_2	Argon Mol Fraction $X_1 \times 10^3$
298.15	0.0	3.05[a]
	0.348	2.22
	0.650	1.60
	1.000	0.877[b]

a. Hiraoka, H.; Hildebrand, J. H. J. Phys. Chem. 1964, 68, 213.
b. Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M. J. Phys. Chem. 1957, 61, 1078.

The argon solubility is almost linear in the benzene mole fraction. The equation

$$X_1 = 3.017 \times 10^{-3} - 2.163 \times 10^{-3} X_2$$

reproduces the argon solubility with an average deviation of less than 2 per cent.

AUXILIARY INFORMATION

METHOD:

Saturation of the liquid with gas at a partial pressure of 1 atm.

APPARATUS/PROCEDURE:

The Dymond-Hildebrand (1) apparatus which uses an all-glass pumping system to spray slugs of degassed solvent into the gas. The amount of gas dissolved is calculated from the initial and final gas pressures.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Stated to be highest purity commercially obtainable.
2. Benzene. Matheson, Coleman and Bell "Spectroquality". Used as received.
3. 1,1,2-Trichloro-1,2,2-trifluoroethane. Matheson, Coleman and Bell. "Spectroquality", used as received.

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.005$

REFERENCES:

1. Dymond, J. H.; Hildebrand, J. H. I. & E. C. Fundam. 1967, 6, 130.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Trichloromethane or Chloroform; $CHCl_3$; 67-66-3

ORIGINAL MEASUREMENTS:

Körösy, F.

Trans. Faraday Soc. 1937, 33, 416-425.

VARIABLES:

T/K: 295.15

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
295.15	0.592	0.165	0.178

The mole fraction and Bunsen solubility values were calculated by the compiler.

AUXILIARY INFORMATION

METHOD:

The apparatus and method of Winkler (1) were used. However, the apparatus was usually not thermostated, and degassing was by evacuating and shaking the solvent, not evacuating and boiling the solvent as was done by Winkler.

APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

1. Argon. No information.

2. Trichloromethane. No information.

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.05$

REFERENCES:

1. Winkler, L. W.
   Ber. 1891, 24, 89.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Tetrachloromethane or Carbon tetrachloride; CCl_4; 56-23-5

ORIGINAL MEASUREMENTS:

Reeves, L. W.; Hildebrand, J. H.

J. Am. Chem. Soc. 1957, 79, 1313-1314.

VARIABLES:

T/K: 252.98 - 284.29
P/kPa: 101.325 (1 atm)

PREPARED BY:

T. D. Kittredge

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
252.98	1.3976	0.341	0.316
264.18	1.3809	0.332	0.321
269.83	1.3736	0.329	0.325
272.65	1.3697	0.326	0.325
284.29	1.3669	0.321	0.334

The Bunsen and Ostwald coefficients were calculated by the compiler.

Smoothed Data: $\Delta G^0/J\ mol^{-1} = -RT \ln X_1 = -430.81 + 56.374\ T$

$Std.\ dev\ \Delta G^0 = 5.9$, $Coef.\ corr. = 0.9999$

$\Delta H^0/J\ mol^{-1} = -430.81$, $\Delta S^0/J\ K^{-1}\ mol^{-1} = -56.374$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^0/J\ mol^{-1}$
248.15	1.400	13,558
253.15	1.394	13,840
258.15	1.388	14,122
263.15	1.383	14,404
268.15	1.378	14,686
273.15	1.373	14,968
278.15	1.368	15,250
283.15	1.364	15,532
288.15	1.360	15,813

AUXILIARY INFORMATION

EVALUATORS NOTE: The data of Reeves and Hildebrand on this sheet are preferred over the data of Graham and Weale on the next page. The Graham and Weale data were not directly measured, but extrapolated from high pressure data.

Jolley and Hildebrand (2) report the partial molal volume of argon dissolved in tetrachloromethane to be (44 ± 1) $cm^3\ mol^{-1}$ at 298.15 K by a dilatometer measurement.

APPARATUS/PROCEDURE:

The apparatus is a modified version of the apparatus of Cook and Hanson (1). The gas is measured and admitted to the degassed solvent. The apparatus is shaken for five minutes. The residual gas is measured. The procedure is repeated until the residual gas volume does not change.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Linde Co. Standard grade, 99.9 per cent pure by spectroscopic analysis.
2. Tetrachloromethane. Reagent grade. Dried over P_2O_5, shaken with Hg, distilled through a vacuum jacketed column at a reflux ratio of 15:1. Nornmal boiling point 76.52 ± 0.05 ^0C., density 1.5845 g cm^{-3} at 298.15 K.

ESTIMATED ERROR:

$\delta T/K = 0.001$
$\delta X_1/X_1 = 0.001$

REFERENCES:

1. Cook, M. W.; Hanson, D. N. Rev. Sci. Instr. 1957, 28, 370.
2. Jolley, J. E.; Hildebrand, J. H. J. Am. Chem. Soc. 1958, 80, 1050.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Tetrachloromethane or Carbon tetrachloride; CCl_4; 56-23-5

ORIGINAL MEASUREMENTS:

Graham, E. B.; Weale, K. E.

Progr. Internat. Res. Thermodynamic and Transport Properties, Symposium on Thermophysical Properties, 2nd., Princeton, 1962, 153 - 158.
Chem. Abstr. 1962, 57, 1616i.

VARIABLES:

T/K: 323.15 - 373.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
323.15	1.4	0.31_5	0.37
348.15	1.35	0.293	0.373
373.15	1.35	0.284	0.388

The authors measured the solubility at high pressure of 50 to 305 bars. They fitted the solubility to the equation $S = aP + bP^2$. The solubility values above were estimated from the equation at a pressure of 1 atm.

See page 309 for the high pressure solubility values for the system.

The compiler calculated the Bunsen and Ostwald coefficients.

Smoothed Data: The combined data of Reeves and Hildebrand (preceding page) and Graham and Weale, except for the 323.15 K value, in a linear regression of Gibbs energy of solution linear in temperature gave the tentative equation for the mole fraction solubility of argon in tetrachloromethane between 248.15 and 373.15 K.

$$\Delta G^0/\mathrm{J\ mol^{-1}} = -RT \ln X_1 = -183.63 + 55.452\ T$$

Std. dev. $\Delta G^0 = 10.6$, Coef. corr. = 0.9999

The equation based on the Reeves and Hildebrand data alone is preferred.

(See preceding page.)

AUXILIARY INFORMATION

METHOD:

See the high pressure argon + tetrachloromethane data sheet for details.

See page 213 for the Evaluator's note, and a value of the argon partial molal volume in tetrachloromethane.

APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Fluorobenzene; C_6H_5F; 462-06-6

ORIGINAL MEASUREMENTS:

Saylor, J. H.; Battino, R.

J. Phys. Chem. 1958, *62*, 1334-1337.

VARIABLES:

T/K: 288.15 - 328.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
288.15	1.15	0.276	0.291
298.15	1.15	0.273	0.298
313.15	1.16	0.270	0.310
328.15	1.14	0.261	0.313

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -121.76 + 56.67\ T$

Std. Dev. $\Delta G° = 17.6$, Coef. Corr. = 0.9998

$\Delta H°/J\ mol^{-1} = -121.76$, $\Delta S°/J\ K^{-1}\ mol^{-1} = -56.67$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/J\ mol^{-1}$
288.15	1.15	16,207
293.15	1.15	16,490
298.15	1.15	16,774
303.15	1.15	17,057
308.15	1.15	17,340
313.15	1.15	17,624
318.15	1.15	17,907
323.15	1.15	18,190
328.15	1.15	18,474

The solubility values were adjusted to a partial pressure of argon gas of 101.325 kPa (1 atm) by Henry's law.
The Bunsen coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was based on the design by Morrison and Billett (1), and the version used was described by Clever, Battino, Saylor, and Gross (2).

The degassed solvent was passed through a helical glass tube containing the gas. The gas dissolves rapidly and the saturated liquid flows into a buret system. The volume of gas dissolved was determined by the increase in the liquid level in the buret system at constant pressure. The volume of the solvent was determined in the burets.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Research grade.
2. Fluorobenzene. Eastman White label. Dried over P_4O_{10}, distilled, b.p. 84.28-84.68°C.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 1$
$\delta X/X = 0.02$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M. *J. Phys. Chem.* 1957, *61*, 1078.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Hexafluorobenzene; C_6F_6; 392-56-3

ORIGINAL MEASUREMENTS:

Evans, D. F.; Battino, R.

J. Chem. Thermodyn. 1971, 3, 753-760.

VARIABLES:

T/K: 282.95 - 297.85
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
282.95	2.465	0.488	0.506
282.96	2.472	0.490	0.508
297.68	2.397	0.465	0.507
297.75	2.402	0.466	0.508
297.85	2.401	0.466	0.508

The Bunsen coefficients were calculated by the compiler.

The solubility values were adjusted to an argon partial pressure of 101.325 kPa (1 atm) by Henry's law.

Smoothed Data: $\Delta G^o/J\ mol^{-1} = -RT \ln X_1 = -1331.0 + 54.624\ T$

Std. Dev. $\Delta G^o = 3.2$, Coeff. Corr. = 0.9999

$\Delta H^o/J\ mol^{-1} = -1331.0$, $\Delta S^o/J\ K^{-1}\ mol^{-1} = -54.624$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^o/J\ mol^{-1}$
278.15	2.49	13,862
283.15	2.47	14,136
288.15	2.44	14,409
293.15	2.42	14,682
298.15	2.40	14,955

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Inc. 99.995 per cent.
2. Hexafluorobenzene. Imperiel Smelting Co., Avnomouth, U.K. GC purity 99.7%, density, $\rho_{298.15} = 1.60596\ g\ cm^{-3}$ Purification described Anal. Chem. 1968, 40, 224.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.005$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. J. Am. Oil Chem. Soc. 1968, 45, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. Anal. Chem. 1971, 43, 806.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Chlorobenzene; C_6H_5Cl; 108-90-7

ORIGINAL MEASUREMENTS:

Saylor, J. H.; Battino, R.

J. Phys. Chem. 1958, 62, 1334-1337.

VARIABLES:

T/K: 288.15 - 328.15

P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
288.15	0.864	0.191	0.202
298.15	0.852	0.187	0.204
313.15	0.864	0.187	0.214
328.15	0.882	0.187	0.225

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = 495.3 + 57.0\ T$

Std. Dev. $\Delta G°$ = 24.5, Coef. Corr. = 0.9997

$\Delta H°/J\ mol^{-1} = 495.3$, $\Delta S°/J\ K^{-1}\ mol^{-1} = -57.0$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/J\ mol^{-1}$
288.15	0.855	16,925
293.15	0.858	17,210
298.15	0.861	17,495
303.15	0.864	17,780
308.15	0.867	18,065
313.15	0.869	18,350
318.15	0.872	18,635
323.15	0.874	18,920
328.15	0.877	19,205

The solubility values were adjusted to a partial pressure of argon gas of 101.325 kPa (1 atm) by Henry's law.

The Bunsen coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was based on the design by Morrison and Billett(1), and the version used was described by Clever, Battino, Saylor, and Gross (2).

The degassed solvent was passed through a helical glass tube containing the gas. The gas dissolves rapidly and the saturated liquid flows into a buret system. The volume of gas dissolved was determined by the increase in the liquid level in the buret system at constant pressure. The volume of the solvent was determined in the burets.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Research grade.
2. Chlorobenzene. Eastman white label. Dried over P_4O_{10}, distilled, b.p. 131.67 - 131.71 °C.

ESTIMATED ERROR:

$\delta T/K = 0.03$

$\delta P/mmHg = 1$

$\delta X/X = 0.02$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033.

2. Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M. J. Phys. Chem. 1957, 61, 1078.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1,4-Dimethylbenzene (p-Xylene); C_8H_{10}; 106-42-3
3. 1,4-Dichlorobenzene; $C_6H_4Cl_2$; 106-46-7

ORIGINAL MEASUREMENTS:

Clever, H.L.

J. Phys. Chem. 1957, *61*, 1082-1083.

VARIABLES:

T/K: 303.15
P/kPa: 101.325 (1 atm)
1,4-Dichlorobenzene/X_3: 0-0.455

PREPARED BY:

C.E. Edelman
A.L. Cramer

EXPERIMENTAL VALUES:

T/K	1,4-Dichloro-benzene Mol Fraction X_3	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
303.15	0.0	1.25	0.225	0.250
303.15	0.170	1.17	0.213	0.236
303.15	0.310	1.09	0.202	0.224
303.15	0.455	1.02	0.191	0.212

The mole fraction solubility of argon correlates well in a linear function with the mole fraction of 1,4-dichlorobenzene in the mixed solvent.

$$X_1 \times 10^3 = 1.25 - 0.511\ X_3 \qquad (r = 0.9992)$$

The solubility values were adjusted to a partial pressure of argon of 101.325 kPa (1 atm) by Henry's law.

The Bunsen coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD:

Volumetric. The solvent is saturated with gas as it flows through an 8 mm x 180 cm glass helix attached to a gas buret. The total pressure of solute gas plus solvent vapor is maintained at 1 atm as the gas is absorbed.

APPARATUS/PROCEDURE:

The apparatus is a modification of the apparatus of Morrison and Billett (1). The modifications include the addition of a helical storage for the solvent, a manometer for a reference pressure, and an extra buret for highly soluble gases. The solvent is degassed by a modification of the method of Baldwin and Daniel (2).

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co.
2. 1,4-Dimethylbenzene. Eastman Kodak white label. Distilled.
3. 1,4-Dichlorobenzene. Eastman Kodak white label. Recrystallized twice from methanol, dried in air.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/mmHg = 3$
$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Morrison, T.J.; Billett, F. *J. Chem. Soc.* 1948, 2033; *Ibid.* 1952, 3819.
2. Baldwin, R.R.; Daniel, S.G. *J. Appl. Chem.* 1952, *2*, 161.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Bromobenzene; C_6H_5Br; 108-86-1

ORIGINAL MEASUREMENTS:

Saylor, J. H.; Battino, R.

J. Phys. Chem. 1958, 62, 1334-1337.

VARIABLES:

T/K: 288.15 - 328.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
288.15	0.675	0.145	0.153
298.15	0.676	0.144	0.157
313.15	0.687	0.144	0.165
328.15	0.710	0.147	0.176

Smoothed Data: $\Delta G°/\text{J mol}^{-1} = - RT \ln X_1 = 1{,}017.2 + 57.2\ T$

Std. Dev. $\Delta G° = 20.9$, Coef. Corr. = 0.9998

$\Delta H°/\text{J mol}^{-1} = 1{,}017.2$, $\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -57.2$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/\text{J mol}^{-1}$
288.15	0.670	17,509.1
293.15	0.675	17,795.3
298.15	0.679	18,081.5
303.15	0.684	18,367.6
308.15	0.689	18,653.8
313.15	0.693	18,940.0
318.15	0.697	19,226.2
323.15	0.701	19,512.3
328.15	0.705	19,798.5

The solubility values were adjusted to a partial pressure of argon gas of 101.325 kPa (1 atm) by Henry's law.

The Bunsen coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was based on the design by Morrsion and Billett (1), and the version used was described by Clever, Battino, Saylor, and Gross (2).

The degassed solvent was passed through a helical glass tube containing the gas. The gas dissolves rapidly and the saturated liquid flows into a buret system. The volume of gas dissolved was determined by the increase in the liquid level in the buret system at constant pressure. The volume of the solvent was determined in the burets.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Research grade.
2. Bromobenzene. Eastman, white label. Dried over P_4O_{10}, distilled, b.p. 155.86 - 155.90°C

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/\text{mmHg} = 1$
$\delta X/X = 0.02$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033.
2. Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M. J. Phys. Chem. 1957, 61, 1078.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1,4-Dimethylbenzene (p-Xylene); C_8H_{10}; 106-42-3
3. 1,4-Dibromobenzene; $C_6H_4Br_2$; 106-37-6

ORIGINAL MEASUREMENTS:

Clever, H.L.

J. Phys. Chem. 1957, 61, 1082-1083.

VARIABLES:

T/K: 303.15
P/kPa: 101.325 (1 atm)
1,4-Dibromobenzene/X_3: 0 - 0.255

PREPARED BY:

C.E. Edelman
A.L. Cramer

EXPERIMENTAL VALUES:

T/K	1,4-Dibromo-benzene Mol Fraction X_3	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
303.15	0.0	1.25	0.225	0.250
	0.130	1.12	0.203	0.225
	0.255	1.01	0.184	0.204

The mole fraction solubility of argon correlates well in a linear function with the mole fraction of 1,4-dibromobenzene in the mixed solvent.

$$X_1 \times 10^3 = 1.25 - 0.942\ X_3 \qquad (r = 0.9993)$$

The solubility values were adjusted to a partial pressure of argon of 101.325 kPa (1 atm) by Henry's law.

The Bunsen coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD:

Volumetric. The solvent is saturated with gas as it flows through an 8 mm x 180 cm glass helix attached to a gas buret. The total pressure of solute gas plus solvent vapor is maintained at 1 atm as the gas is absorbed.

APPARATUS/PROCEDURE:

The apparatus is a modification of the apparatus of Morrison and Billett (1). The modifications include the addition of a helical storage for the solvent, a manometer for a reference pressure, and an extra buret for highly soluble gases. The solvent is degassed by a modification of the method of Baldwin and Daniel (2).

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co.
2. 1,4-Dimethylbenzene. Eastman Kodak white label. Distilled.
3. 1,4-Dibromobenzene. Eastman Kodak white label. Recrystallized twice from methanol, dried in air.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/mmHg = 3$
$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Morrison, T.J.; Billett, F. J. Chem. Soc. 1948, 2033; Ibid. 1952, 3819.
2. Baldwin, R.R.; Daniel, S.G. J. Appl. Chem. 1952, 2, 161.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Iodobenzene; C_6H_5I; 591-50-4

ORIGINAL MEASUREMENTS:

Saylor, J. H.; Battino, R.

J. Phys. Chem. 1958, *62*, 1334-1337

VARIABLES:

T/K: 288.15 - 328.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
288.15	0.486	0.099	0.104
298.15	0.497	0.100	0.109
313.15	0.521	0.103	0.118
328.15	0.560	0.109	0.131

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = 2{,}804.8 + 53.786\ T$

Std. Dev. $\Delta G° = 30.4$, Coef. Corr. = 0.9995

$\Delta H°/J\ mol^{-1} = 2{,}804.8$, $\Delta S°/J\ K^{-1}\ mol^{-1} = -53.786$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/J\ mol^{-1}$
288.15	0.481	18,303
293.15	0.491	18,572
298.15	0.500	18,841
303.15	0.510	19,110
308.15	0.519	19,379
313.15	0.528	19,648
318.15	0.537	19,917
323.15	0.546	20,186
328.15	0.555	20,454

The solubility values were adjusted to a partial pressure of argon gas of 101.325 kPa (1 atm) by Henry's law.

The Bunsen coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was based on the design by Morrison and Billett (1), and the version used was described by Clever, Battino, Saylor, and Gross (2).

The degassed solvent was passed through a helical glass tube containing the gas. The gas dissolves rapidly and the saturated liquid flows into a buret system. The volume of gas dissolved was determined by the increase in the liquid level in the buret system at constant pressure. The volume of the solvent was determined in the burets.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Research grade.
2. Iodobenzene. Eastman, white label. Shaken with dil. aq. thiosulfate, washed with water, dried over P_4O_{10}, distilled 77.40 - 77.60°C (30 mmHg).

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 1$
$\delta X/X = 0.02$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M. *J. Phys. Chem.* 1957, *61*, 1078.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1,4-Dimethylbenzene (p-Xylene); C_8H_{10}; 106-42-3
3. 1,4-Diiodobenzene; $C_6H_4I_2$; 624-38-4

ORIGINAL MEASUREMENTS:

Clever, H.L.

J. Phys. Chem. 1957, 61, 1082-1083.

VARIABLES:

T/K: 303.15
P/kPa: 101.325 (1 atm)
1,4-Diiodobenzene/X_3: 0 - 0.078

PREPARED BY:

C.E. Edelman
A.L. Cramer

EXPERIMENTAL VALUES:

T/K	1,4-Diiodo-benzene Mol Fraction X_3	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
303.15	0.0	1.25	0.225	0.250
	0.078	1.13	0.203	0.225

The solubility values were adjusted to a partial pressure of argon of 101.325 kPa (1 atm) by Henry's law.

The Bunsen coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD:

Volumetric. The solvent is saturated with gas as it flows through an 8 mm x 180 cm glass helix attached to a gas buret. The total pressure of solute gas plus solvent vapor is maintained at 1 atm as the gas is absorbed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co.
2. 1,4-Dimethylbenzene. Eastman Kodak white label. Distilled.
3. 1,4-Diiodobenzene. Eastman Kodak white label. Recrystallized twice and dried in air.

APPARATUS/PROCEDURE:

The apparatus is a modification of the apparatus of Morrison and Billett (1). The modifications include the addition of a helical storage for the solvent, a manometer for a reference pressure, and an extra buret for highly soluble gases. The solvent is degassed by a modification of the method of Baldwin and Daniel (2).

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/mmHg = 3$
$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Morrison, T.J.; Billett, F. J. Chem. Soc. 1948, 2033; ibid. 1952, 3819.
2. Baldwin, R.R.; Daniel, S.G. J. Appl. Chem. 1952, 2, 161.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Carbon Disulfide; CS_2; 75-15-0

EVALUATOR:

H. L. Clever
Department of Chemistry
Emory University
Atlanta, GA 30322
USA

June 1979

CRITICAL EVALUATION:

Reeves and Hildebrand (1) report values of the solubility of argon in carbon disulfide at one atmosphere and at five temperatures between 253.13 and 298.14 K. Gjaldbaek and Niemann (2) report three values at 298.15 K.

The average of Gjaldbaek and Niemann's three values is 0.4 percent higher than the smoothed data value of Reeves and Hildebrand at 298.15 K. This is well within the limits of experimental error. The eight experimental values from the two papers were used to obtain the tentative thermodynamic values and mole fraction solubilities. Although we have confidence in the data, they are classed as tentative because there is data on the temperature coefficient of solubility from only one laboratory.

The tentative thermodynamic values for the transfer of one mole of argon from the gas at 101.325 kPa (1 atm) to the hypothetical unit mole fraction solution are

$\Delta G^o/J\ mol^{-1} = -RT\ ln\ X_1 = 1875.9 + 57.135\ T$

Std. Dev. $\Delta G^o = 12.352$, Coeff. Corr. = 0.99993

$\Delta H^o/J\ mol^{-1} = 1875.9$, $\Delta S^o/J\ K^{-1}\ mol^{-1} = -57.135$

The recommended values of the mole fraction solubility at an argon partial pressure of 101.325 kPa and the Gibbs energy of solution are given as a function of temperature in Table 1.

Table 1 Solubility of argon in carbon disulfide at 101.325 kPa. Tentative mole fraction solubility and Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^o/J\ mol^{-1}$
253.15	4.251	16,340
258.15	4.325	16,625
263.15	4.397	16,911
268.15	4.468	17,197
273.15	4.538	17,482
278.15	4.606	17,768
283.15	4.672	18,053
288.15	4.737	18,339
293.15	4.801	18,625
298.15	4.863	18,911

1. Reeves, L. W.; Hildebrand, J. H. *J. Am. Chem. Soc.* 1957, *79*, 1313.

2. Gjaldbaek, J. C.; Niemann, H. *Acta Chem. Scand.* 1958, *12*, 611.

Jolley and Hildebrand (3) report the partial molal volume of argon dissolved in carbon disulfide to be (45 ± 1) $cm^3\ mol^{-1}$ at 298.15 K by a dilatometer measurement.

3. Jolley, J. E.; Hildebrand, J. H. *J. Am. Chem. Soc.* 1958, *80*, 1050.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Carbon disulfide; CS_2; 75-15-0

ORIGINAL MEASUREMENTS:

Reeves, L. W.; Hildebrand, J. H.

J. Am. Chem. Soc. 1957, 79, 1313-1314.

VARIABLES:

T/K: 253.13 - 298.14
P/kPa: 101.325 (1 atm)

PREPARED BY:

T. D. Kittredge

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
253.13	0.4272	0.166	0.154
262.76	0.4391	0.169	0.163
273.22	0.4513	0.172	0.172
283.14	0.4654	0.175	0.181
298.14	0.4866	0.180	0.196

The Bunsen and Ostwald coefficients were calculated by the compiler.

Smoothed Data: $\Delta G^0/\mathrm{J\ mol^{-1}} = -RT \ln X_1 = 1822.4 + 57.338\ T$

Std. dev. $\Delta G^0 = 8.5$, Coef. corr. 0.9999

$\Delta H^0/\mathrm{J\ mol^{-1}} = 1822.4$, $\Delta S^0/\mathrm{J\ K^{-1}\ mol^{-1}} = -57.338$

See the evaluation sheet on the argon + carbon disulfide system for the tentative equation for the system.

AUXILIARY INFORMATION

METHOD

The apparatus is a modified version of the apparatus of Hanson and Cook (1).The gas is measured and admitted to the degassed solvent. The apparatus is shaken for 5 minutes. The residual gas is measured. The procedure is repeated until the residual gas volume does not change.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Linde Co. Standard grade, 99.9 per cent pure by spectroscopic analysis.
2. Carbon disulfide. Reagent grade. Dried over P_2O_5, shaken with Hg, distilled. Density 1.2558 g cm^{-3} at 298.15 K, normal boiling point 46.41 ± 0.05 ^{0}C.

ESTIMATED ERROR:

$\delta T/K = 0.001$
$\delta X_1/X_1 = 0.003$

REFERENCES:

1. Cook, M. W.; Hanson, D. N. Rev. Sci. Instr. 1957, 28, 370.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Carbon disulfide; CS_2 ; 75-15-0

ORIGINAL MEASUREMENTS:

Gjaldbaek, J. C.; Niemann, H.

Acta Chem. Scand. 1958, 12, 611 - 614.

VARIABLES:

T/K; 298.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

J. Chr. Gjaldbaek

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	0.491	0.1815	0.1981
	0.484	0.179	0.195
	0.486	0.1796	0.1960

The Ostwald and mole fraction solubility values were calculated by the compiler. The solubilities are reported for an argon partial pressure of 101.325 kPa (1 atm) assuming Henry's law is obeyed.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A calibrated all-glass combined manometer and bulb was enclosed in an air thermostat and shaken until equilibrium. Mercury was used for calibration and as the confining liquid. The solvents were degassed in the apparatus. Details are in references 1 and 2.

The absorped volume of gas is calculated from the initial and final amounts, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury.

SOURCE AND PURITY OF MATERIALS:

1. Argon. "L'air liquid". Dried, less than 0.05 per cent water.
2. Carbon disulfide. Analytical reagent grade. Distilled, normal boiling point 46.03 °C.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta X_1/X_1 = 0.015$

REFERENCES:

1. Lannung, A.
J. Am. Chem. Soc. 1930, 52, 68.

2. Gjaldbaek, J. C.
Acta Chem. Scand. 1952, 6, 623.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Sulfinylbismethane (Dimethyl Sulfoxide); C_2H_6OS (CH_3SOCH_3); 67-68-5

ORIGINAL MEASUREMENTS:

Dymond, J. H.

J. Phys. Chem. 1967, 71, 1829 - 1831.

VARIABLES:

T/K: 298.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

M. E. Derrick

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	0.154	0.0484	0.0528

The Bunsen and Ostwald coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD:

The liquid is saturated with the gas at a gas partial pressure of 1 atm.

The apparatus is that described by Dymond and Hildebrand (1). The apparatus uses an all-glass pumping system to spray slugs of degassed solvent into the gas. The amount of gas dissolved is calculated from the initial and final gas pressure.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Linde Co. Dried before use.
2. Dimethylsulfoxide. Matheson, Coleman, and Bell Co. Spectroquality reagent. Dried over 4A molecular sieve and a fraction frozen out. Melting point 18.37° C.

ESTIMATED ERROR:

REFERENCES:

1. Dymond, J.; Hildebrand, J. H. Ind. Eng. Chem. Fundam. 1967, 6, 130.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Nitromethane; CH_3NO_2; 75-52-5

ORIGINAL MEASUREMENTS:

Friedman, H. L.

J. Am. Chem. Soc. 1954, *76*, 3294-3297

VARIABLES:

T/K: 298.00
P/kPa: 98.33 (700 mmHg)

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.00			0.138
			0.146
			0.146
	0.315	0.131	0.143 av

The author measured the Ostwald coefficients at about 700 mmHg argon pressure. The Bunsen coefficient and the mole fraction solubility at 101.325 kPa argon pressure (760 mmHg) were calculated by the compiler with the assumptions that the gas is ideal, and that Henry's law is obeyed.

AUXILIARY INFORMATION

METHOD:

Gas absorption. The method was essentially that employed by Eucken and Herzberg (1). Modifications included a magnetic stirring device instead of shaking the saturation vessel, and balancing the gas pressure against a column of mercury with electrical contacts instead of balancing the gas pressure against the atmosphere.

APPARATUS/PROCEDURE: The solvent was degassed by vacuum. The procedure, repeated 5 - 10 times, was to alternate 5 - 15 s evacuation and rapid stirring to produce cavitation. In the solubility measurement, gas, presaturated with solvent vapor, was brought into contact with about 80 ml of solvent in the saturation vessel. Initial conditions were established by a time extrapolation. Solubility equilibrium was approached from both under- and supersaturation by varying the rate.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Linde Air Products. Spectrograde.
2. Nitromethane. Source not given. Distilled, dried by filtering at 253 K.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta P/mmHg = 0.3$
$\delta L/L = 0.03$

REFERENCES:

1. Euken, A.; Herzberg, G. *Z. Phys. Chem.* 1950, *195*, 1.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Nitrobenzene; $C_6H_5NO_2$; 98-95-3

ORIGINAL MEASUREMENTS:

Saylor, J. H.; Battino, R.

J. Phys. Chem. 1958, *62*, 1334-1337.

VARIABLES:

T/K: 288.15 - 328.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
288.15	0.431	0.095	0.100
298.15	0.439	0.096	0.105
313.15	0.477	0.102	0.117
328.15	0.483	0.102	0.123

Smoothed Data: $\Delta G°/\text{J mol}^{-1} = -RT \ln X_1 = 2{,}468.9 + 55.9\,T$

Std. Dev. $\Delta G° = 40.8$, Coef. Corr. = 0.9991

$\Delta H°/\text{J mol}^{-1} = 2{,}468.9$, $\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -55.9$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/\text{J mol}^{-1}$
288.15	0.430	18,571
293.15	0.438	18,850
298.15	0.445	19,130
303.15	0.453	19,409
308.15	0.460	19,689
313.15	0.467	19,968
318.15	0.474	20,247
323.15	0.481	20,527
328.15	0.488	20,806

The solubility values were adjusted to a partial pressure of argon gas of 101.325 kPa (1 atm) by Henry's law.

The Bunsen coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was based on the design by Morrison and Billett (1), and the version used was described by Clever, Battino, Saylor, and Gross (2).

The degassed solvent was passed through a helocal glass tube containing the gas. The gas dissolves rapidly and the saturated liquid flows into a buret system. The volume of gas dissolved was determined by the increase in the liquid level in the buret system at constant pressure. The volume of the solvent was determined in the burets.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Research grade.
2. Nitrobenzene. Eastman white label. Distilled from P_4O_{10}, reduced pressure of 10 mmHg, b.p. 81.0 - 81.2°C.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/\text{mmHg} = 1$
$\delta X/X = 0.02$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* .948, 2033.
2. Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M. *J. Phys. Chem.* 1957, *61*, 1078.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Argon; Ar; 7440-37-1 2. N-Methylacetamide; C_3H_7NO; 79-16-3	Wood, R. H.; DeLaney, D. E. J. Phys. Chem. 1968, 72, 4651 - 4654.

VARIABLES:	PREPARED BY:
T/K: 208.15 - 343.15 P/kPa: 101.325 (1 atm)	P. L. Long

EXPERIMENTAL VALUES:

The authors obtained the equation

$$\ln X_1 = -\ 399.4/T - 1.12 \ln T - 0.0278$$

by a linear regression of their experimental data. The equation can be rearranged to

$$\Delta G° = -\ RT \ln X_1 = 399.4R + 1.12\ RT \ln T + 0.0278\ RT$$

The experimental data were not included in the paper. They are available in a thesis (1). The smoothed mole fraction argon solubilities at 101.325 kPa Ar gas and five degree intervals between 308.15 and 343.15 K were given in the paper. The Bunsen and Ostwald coefficients were calculated by the compiler.

Smoothed Data:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
308.15	0.4444	0.1289	0.1455
313.15	0.4456	0.1287	0.1476
318.15	0.4466	0.1285	0.1496
323.15	0.4476	0.1282	0.1517
328.15	0.4483	0.1278	0.1536
333.15	0.4490	0.1275	0.1555
338.15	0.4494	0.1270	0.1572
343.15	0.4498	0.1266	0.1590

AUXILIARY INFORMATION

METHOD:

APPARATUS/PROCEDURE: A gas buret was connected to a solvent buret through a three-way capillary stopcock. A measured volume of gas was transferred to a known volume of solvent; when equilibrium was reached the total pressure and volume of the system was measured (1). The apparatus and procedure were checked by measuring the solubility of Ar in H_2O at 298.15 K. The Bunsen coefficient of 0.03105 checked well with the literature (2).

SOURCE AND PURITY OF MATERIALS:

1. Argon. Source not given. Purity 99.99 per cent.
2. N-Methylacetamide. Source not given. Recrystallized three times in a dry box. Typically had a water content of 0.04 mol per cent after a solubility run.

DATA CLASS:

ESTIMATED ERROR:

Duplicate runs checked to within 0.5 percent.

REFERENCES:

1. DeLaney, D. E.
M. S. Thesis, University of Delaware, 1968.

2. Ben-Naim, A.; Baer, S.
Trans. Faraday Soc. 1963, 59, 2735; ibid. 1964, 60, 1736.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1,1,2,2,3,3,4,4,4-Nonafluoro-N,N-bis(nonafluorobutyl)-1-butanamine or Perfluorotributylamine; $(C_4F_9)_3N$; 311-89-7

ORIGINAL MEASUREMENTS:

Kobatake, Y.; Hildebrand, J. H.

J. Phys. Chem. 1961, *65*, 331 - 335.

VARIABLES:

T/K: 277.65 - 304.98

P/kPa: 101.325 (1 atm)

PREPARED BY:

C. E. Eddleman
M. E. Derrick

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
277.65	5.322	0.342	0.348
284.78	5.205	0.332	0.346
292.58	5.083	0.321	0.344
298.74	4.992	0.314	0.343
304.98	4.906	0.306	0.342

The Bunsen and Ostwald coefficients were calculated by the compiler.

Smoothed Data: $\Delta G^0/\mathrm{J\ mol^{-1}} = -2{,}097.3 + 51.084\ T$

Std. dev. $\Delta G^0 = 0.7$, Coef. corr. = 0.9999

$\Delta H^0/\mathrm{J\ mol^{-1}} = -2{,}097.3$, $\Delta S^0/\mathrm{J\ K^{-1}\ mol^{-1}} = -51.084$

T/K	Mol Fraction $X_1 \times 10^3$	Gibbs Energy $\Delta G^0/\mathrm{J\ mol^{-1}}$
273.15	5.404	11,856
278.15	5.315	12,112
283.15	5.230	12,367
288.15	5.150	12,623
293.15	5.074	12,878
298.15	5.001	13,133
303.15	4.932	13,389
308.15	4.866	13,644

AUXILIARY INFORMATION

METHOD: The apparatus consists of a gas measuring buret, an absorption pipet, and a reservoir for the solvent. The buret is thermostated at 25 °C, the pipet at any temperature from 5 to 30 °C. The pipet contains an iron bar in glass for magnetic stirring. The pure solvent is degassed by freezing with liquid nitrogen, evacuating, then boiling with a heat lamp. The degassing process is repeated three times. The solvent is flowed into the pipet where it is again boiled for final degassing. Manipulation of the apparatus is such that the solvent never comes in contact with stopcock grease. The liquid in the pipet is sealed off by mercury. Its volume is the difference between the capacity of the pipet and the volume of mercury that confines it. Gas is admitted into the pipet. Its exact amount is determined by P-V measurements in the buret before and after introduction of the gas into the pipet. The stirrer is set in motion. Equilibrium is attained within 24 hours.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Linde Co. Standard grade, 99.9 per cent.
2. Perfluorotributylamine. Minnesota Mining and Manufacturing Co. Dried, fractionated, boiling point 178.5 - 179.0 °C. Density, $\rho/\mathrm{g\ cm^{-3}} = 1.872$.

ESTIMATED ERROR:

$\delta T/K = 0.02$

$\delta X_1/X_1 = 0.003$

EVALUATION: The data of Powell (next page) are preferred. Apparently the solvent sample used in this work was of inferior quality (1).

1. Powell, R. J.
J. Chem. Eng. Data 1972, *17*, 302.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. 1,1,2,2,3,3,4,4,4-Nonafluoro-N,N-bis(nonafluorobutyl)-1-butanamine or Perfluorotributylamine; $C_{12}F_{27}N$; 311-89-7

ORIGINAL MEASUREMENTS:

Powell, R. J.

J. Chem. Eng. Data 1972, *17*, 302-304.

VARIABLES:

T/K: 288.15 - 318.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L	$N = R\frac{\Delta \log X_1}{\Delta \log T}$
298.15	6.105	0.386	0.421	-1.54

The Bunsen and Ostwald ceofficients were calculated by the compiler.

The author stated that the solubility measurements were made at temperatures between 288.15 and 318.15 K, but only the 298.15 K solubility value was given in the paper. The slope $N = R(\Delta \log X_1/\Delta \log T)$ was given.

Smoothed Data: The smoothed data below were calculated by the compiler from the slope in the form:

$$\log X_1 = \log(6.105 \times 10^{-3}) - (1.54/R) \log (T/298.15)$$

with $R = 1.9872$ cal K^{-1} mol^{-1}.

T/K	Mol Fraction $X_1 \times 10^3$
288.15	6.27
293.15	6.19
298.15	6.11
303.15	6.03
308.15	5.95
313.15	5.88
318.15	5.81

EVALUATOR'S NOTE: These data are preferred over the data of Kobatake and Hildebrand. See the EVALUATION at the bottom of the preceeding page.

AUXILIARY INFORMATION

METHOD:

APPARATUS/PROCEDURE: The apparatus is the Dymond and Hildebrand (1) apparatus which uses an all glass pumping system to spray slugs of degassed solvent into the gas. The amount of gas dissolved is calculated from the initial and final pressures. The solvent is degassed by freezing, pumping, and followed by boiling under reduced pressure.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Source not given. Research grade, dried over $CaCl_2$ before use.

2. 1,1,2,2,3,3,4,4,4-Nonafluoro-N,N-bis(nonafluorobutyl)-1-butanamine. Minnesota Mining & Manufacturing Co. Distilled, used portion boiling between 447.85 - 448.64 K which gave a single GLC peak. $\rho_{298.15} = 1.880$ g cm^{-3}.

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.002$
$\delta N/\text{cal } K^{-1} \text{ mol}^{-1} = 0.1$

REFERENCES:

1. Dymond, J. H.; Hildebrand, J. H. *Ind. Eng. Chem. Fundam.* 1967, *6*, 130.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Hydrazine; NH_2NH_2; 302-01-2

ORIGINAL MEASUREMENTS:

Chang, E. T.; Gokcen, N. A.; Poston, T. M.

J. Phys. Chem. 1968, *72*, 638 - 642.

VARIABLES:

T/K: 278.15 - 308.18
P/kPa: 92.81 - 215.14
(0.9160 - 2.1233 atm)

PREPARED BY:

A. L. Cramer
P. L. Long

EXPERIMENTAL VALUES:

T/K	P/Atm	Henry's Constant K x 10^5	Mol Fraction X_1 x 10^5	Bunsen Coefficient α	Ostwald Coefficient L
278.15	1.1417	0.91	1.04		
	2.1233	1.03	2.20		
	1.0	0.97	0.97	0.0069	0.0070
293.16	0.9160	1.13	1.03		
	1.7985	1.19	2.13		
	1.0	1.16	1.16	0.0082	0.0088
308.18	1.0567	1.36	1.44		
	2.0129	1.42	2.85		
	1.0	1.39	1.39	0.0097	0.0109

The Henry's constant is defined as $K/\text{atm}^{-1} = X_1/P/\text{atm}$.
The solubility values at one atm were calculated from the average Henry's constant by the compiler.

Smoothed Data: The mole fraction solubility at 1 atm argon pressure.

$\Delta G^\circ/\text{J mol}^{-1} = -RT \ln X_1$

$= 8553.7 + 65.2787$

Std. Dev. $\Delta G^\circ = 26.5$, Coef. Corr. = 0.9996

$\Delta H^\circ/\text{J mol}^{-1} = 8553.7$, $\Delta S^\circ/\text{J K}^{-1}\text{ mol}^{-1} = -65.278$

T/K	Mol Fraction X_1 x 10^5	$\Delta G^\circ/\text{J mol}^{-1}$
278.15	0.96	26,711
288.15	1.10	27,364
298.15	1.23	28,016
308.15	1.38	28,669

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solvent was degassed under vacuum in the previously weighed apparatus. Apparatus and degassed solvent weighed. Gas was introduced into the apparatus at a known P and T. The liquid was stirred, and the pressure was observed until there was no further change. Hydrazine did not appear to decompose with time as did the substituted hydrazines.

The apparatus was of all glass construction. It consisted of three calibrated volumes for the measurement of the gas, a container for the solvent, which was stirred with a glass enclosed magnet, and a manometer for measuring the pressure with a microslide cathetometer. The solvent container had a capacity for 100 g of solvent with a 5 ml gas space above the liquid surface. The apparatus sections were calibrated to ± 0.0002-3 cm^3 (1). There are no additional solubility data in the author's other discussions (2,3) of the system.

SOURCE AND PURITY OF MATERIALS:

1. Argon. No information given.

2. Hydrazine. No information on source. It was freshly distilled before use. The density was measured, and fitted to the equation:

   $\rho/\text{g ml}^{-1} = 1.02492 - 0.000865t/C.$

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/\text{mmHg} = 0.01$
$\delta X_1/X_1 = 0.05$

REFERENCES:

1. Chang, E. T.; Gokcen, N. A. *J. Phys. Chem.* 1966, *70*, 2394.

2. Chang, E.T.; Gokcen, N.A.; Poston, T.M. *J. Spacecr. Rockets* 1969, *6*, 1177.

3. Gokcen, N. A.; Chang, E. T. *J. Chem. Ed.* 1977, *54*, 368.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Methylhydrazine; $NHCH_3NH_2$; 60-34-4

ORIGINAL MEASUREMENTS:

Chang, E. T.; Gokcen, N. A.
Poston, T. M.

J. Phys. Chem. 1968, 72, 638 - 642.

VARIABLES:

T/K: 253.24 - 298.14
P/kPa: 113.13 - 206.14
(1.1165 - 2.0344 atm)

PREPARED BY:

P. L. Long
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	P/Atm	Henry's Constant $K \times 10^5$	Mol Fraction $X_1 \times 10^5$	Bunsen Coefficient α	Ostwald Coefficient L
253.24	1.1165	14.91	16.65		
	2.0127	14.77	29.75		
	1.0	14.85	14.85	0.0659	0.0611
273.15	1.1685	15.91	18.59		
	2.0344	16.02	32.60		
	1.0	15.97	15.97	0.0694	0.0694
298.14	1.1680	17.98	21.00		
	2.0182	18.04	36.40		
	1.0	18.0	18.0	0.0762	0.0832

The Henry's constant is defined $K/\text{atm}^{-1} = X_1/P/\text{atm}$.

The solubility values at 1 atm were calculated from the average Henry's constant by the compiler.

Smoothed Data:

$\Delta G^\circ/\text{J mol}^{-1} = -RT \ln X_1$

$= 2734.5 + 62.560\ T$

Std. Dev. $\Delta G^\circ = 27.0$,

Coef. Corr. = 0.9998

$\Delta H^\circ/\text{J mol}^{-1} = 2734.5$,

$\Delta S^\circ/\text{J K}^{-1}\ \text{mol}^{-1} = -62.560$

T/K	Mol Fraction $X_1 \times 10^5$	$\Delta G^\circ/\text{J mol}^{-1}$
258.15	15.1	18,884
268.15	15.8	19,510
278.15	16.5	20,136
288.15	17.2	20,761
298.15	17.9	21,387

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solvent was degassed under vacuum in the previously weighed apparatus. Apparatus and degassed solvent were weighed. Gas was introduced into the apparatus at a known P and T, the liquid stirred, and the pressure observed until there was no further change. Equilibrium was established within 10 m and the P was followed for 40 m. Substituted hydrazines appear to decompose with time. For decomposing solvents the P was followed for up to 2 h, and the solubility value was corrected for the gaseous decomp. prod.

The apparatus was of all Pyrex glass construction. It consisted of three calibrated volumes for the measurement of the gas, a container for the solvent, which was stirred with a glass enclosed magnet, and a manometer with a microslide cathetometer for measuring the pressure. The solvent container had a capacity for 100 g of solvent with a 5 ml gas space above the liquid surface. The apparatus sections were calibrated to ± 0.0002 - 3 cm^3 (1). See comment on page 232 about additional references.

SOURCE AND PURITY OF MATERIALS:

1. Argon. No information given.

2. Methylhydrazine. Source not given. Distilled prior to use. Density, $\rho/\text{g ml}^{-1} = 0.89338 - 0.000943t/^\circ C$.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/\text{mmHg} = 0.01$
$\delta X_1/X_1 = 0.05$

REFERENCES:

1. Chang, E. T.; Gokcen, N. A. J. Phys. Chem. 1966, 70, 2394.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1,1-Dimethylhydrazine; $N(CH_3)_2NH_2$; 57-14-7

ORIGINAL MEASUREMENTS:

Chang, E. T.; Gokcen, N. A.
Poston, T. M.

J. Phys. Chem. 1968, 72, 638 - 642.

VARIABLES:

T/K: 253.05 - 293.16
P/kPa: 97.12 - 201.58
(0.9585 - 1.9894 atm)

PREPARED BY:

P. L. Long
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	P/Atm	Henry's Constant $K \times 10^5$	Mol Fraction $X_1 \times 10^5$	Bunsen Coefficient α	Ostwald Coefficient L
253.05	0.9695	64.39	62.43		
	1.9448	64.36	125.2		
	1.0	64.38	64.38	0.200	0.185
273.15	1.1590	65.87	76.35		
	1.9894	65.87	131.0		
	1.0	65.87	65.87	0.199	0.199
293.16	0.9585	68.69	65.84		
	1.7669	68.75	121.5		
	1.0	68.73	68.73	0.201	0.216

The Henry's constant is defined as $K/\text{atm}^{-1} = X_1/P/\text{atm}$. The solubility values at one atm were calculated from the average Henry's constant by the compiler.

Smoothed Data: Mole fraction solubility at one atm.

$\Delta G^o/J\ mol^{-1} = -RT \ln X_1$

$= 1012.2 + 57.130\ T$

Std. Dev. $\Delta G^o = 16.4$,

Coef. Corr. = 0.9999

$\Delta H^o/J\ mol^{-1} = 1012.2$,

$\Delta S^o/J\ K^{-1}\ mol^{-1} = -57.130$

T/K	Mol Fraction $X_1 \times 10^5$	$\Delta G^o/J\ mol^{-1}$
258.15	64.7	15,760
268.15	65.9	16,332
278.15	67.0	16,903
288.15	68.0	17,474
298.15	68.9	18,046

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solvent was degassed under vacuum in the previously weighed apparatus. Apparatus and degassed solvent were weighed. Gas was introduced into the apparatus at a known P and T, the liquid stirred, and the pressure observed until there was no further change. Equilibrium was established within 10 m and the P was followed for 40 m. Substituted hydrazines appear to decompose with time. For decomposing solvents the P was followed for up to 2 h, and the solubility value was corrected for the gaseous decomp. prod. The apparatus was of all Pyrex glass construction. It consisted of three calibrated volumes for the measurement of the gas, a container for the solvent, which was stirred with a glass enclosed magnet, and a manometer with a microslide cathetometer for measuring the pressure. The solvent container had a capacity for 100 g of solvent with a 5 ml gas space above the liquid surface. The apparatus sections were calibrated to ± 0.0002 - 3 cm^3 (1). See comment on page 232 about additional references.

SOURCE AND PURITY OF MATERIALS:

1. Argon. No information given.
2. 1,1-Dimethylhydrazine. Source not given. Distilled just prior to use. Density, $\rho/g\ ml^{-1} = 0.80980 - 0.001030\ t/^oC$

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.01$
$\delta X_1/X_1 = 0.05$

REFERENCES:

1. Chang, E. T.; Gokcen, N. A. J. Phys. Chem. 1966, 70, 2394.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Argon; Ar; 7440-37-1 2. 1,2-Dimethylhydrazine; $NHCH_3NHCH_3$; 540-73-8	Chang, E. T.; Gokcen, N. A. Poston, T. M. J. Phys. Chem. 1968, 72, 638-642.
VARIABLES: T/K: 273.15 - 298.15 P/kPa: 101.325	PREPARED BY: P. L. Long

EXPERIMENTAL VALUES:

The authors made no experimental measurements on this system. The authors do given an estimated Gibbs energy equation for the solution of argon in 1,2-dimethylhydrazine. They used logical assumptions to find a linear relationship between the Gibbs energy of solution of argon in hydrazine, methylhydrazine, and 1,1-dimethylhydrazine as a function of $1/r^{12}$, where r is the distance of approach of solvent and solute molecules. The value of r in each solvent was determined from a simple cell model. The linear relationship was extrapolated to obtain the estimated value of the Gibbs energy of solution of argon in 1,2-dimethylhydrazine. The estimated equation is

$$\Delta G^{o}/\mathrm{cal\ mol^{-1}} = -RT \ln K/\mathrm{atm}^{-1} = 720 + 9.05\ T$$

where K is the Henry's constant defined as $K/\mathrm{atm}^{-1} = X_1/P$. The pressure is in atm. The mole fraction solubilities at 101.325 kPa (1 atm) tabulated below were calculated from the equation by the compiler.

T/K	Henry's Constant $K \times 10^5$	Mol Fraction $X_1 \times 10^5$
273.15	279	279
278.15	286	286
283.15	293	293
288.15	299	299
293.15	306	306
298.15	312	312

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Estimated data, see above.	
	ESTIMATED ERROR:
	REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Hydrazine; NH_2NH_2; 302-01-2
3. 1,1-Dimethylhydrazine; $N(CH_3)_2NH_2$; 57-14-7

ORIGINAL MEASUREMENTS:

Chang, E. T.; Gokcen, N. A.

J. Phys. Chem. 1968, *72*, 2556-2562.

VARIABLES:

T/K: 273.15 - 303.15
P/kPa: 50.66 - 253.31
(0.5 - 2.5 atm)

PREPARED BY:

P. L. Long

EXPERIMENTAL VALUES:

Mol Fraction 1,1-Dimethylhydrazine/X_3	Gibbs Energy ΔG^o/cal mol^{-1} = $-RT \ln K$/atm^{-1}	Henry's Constant K/atm^{-1} = X_1/P/atm K x 10^5 at 288.15K	Mol Fraction $X_1 \times 10^5$ at 1 atm and 288.15 K
0.0	2040 + 15.61 T*	1.10	1.10
0.1	1490 + 15.6 T	2.89	2.89
0.2	1080 + 15.6 T	5.91	5.91
0.3	810 + 15.5 T	9.96	9.96
0.4	730 + 15.1 T	14.0	14.0
0.5	700 + 14.5 T	20.0	20.0
0.6	640 + 14.1 T	27.1	27.1
0.7	560 + 13.9 T	34.5	34.5
0.8	470 + 13.8 T	42.4	42.4
0.9	360 + 13.7 T	54.1	54.1
1.0	240 + 13.67 T*	67.7	67.7

*Based on experimental values. The Gibbs energy equations for the mixtures were estimated.

The Gibbs energy equation was fitted to data taken in the 273.15 - 303.15K temperature range.

The Henry's constant is based on data measured over the 0.5 - 2.5 atm pressure range. The value in the Table above is the Henry's constant at 288.15 K. Values at other temperatures can be calculated from the Gibbs energy equation.

The mole fraction solubility at 288.15 K and 101.325 kPa (1 atm) was calculated by the compiler.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The solvent was degassed under vacuum in the previously weighed apparatus. Apparatus and degassed solvent were weighed. Gas was introduced into the apparatus at a known P and T, the liquid stirred, and the pressure observed until there was no further change. Equilibrium was established within 10 m and the P was followed for 40 m. Substituted hydrazines appear to decompose with time. For decomposing solvents the P was followed for up to 2 h, and the solubility value was corrected for the gaseous decomp. product.

The apparatus was of all Pyrex glass construction. It consisted of three calibrated volumes for the measurement of the gas, a container for the solvent, which was stirred with a glass enclosed magnet, and a manometer with a microslide cathetometer for measuring the pressure. The solvent container had a capacity for 100 g of solvent with a 5 ml gas space above the liquid surface.

The apparatus sections were calibrated to ± 0.0002 - 3 cm^3 (1).

SOURCE AND PURITY OF MATERIALS:

The source and purity of the materials were not given. The density and refractive index of the solvent components and several of their mixtures are given. The solvents were freshly distilled before use.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.01$
$\delta X_1/X_1 = 0.05$

REFERENCES:

1. Chang, E. T.; Gokcen, N. A. *J. Phys. Chem.* 1966, *70*, 2394.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Nitrogen Oxide; N_2O_4; 10544-72-6

ORIGINAL MEASUREMENTS:

Chang, E. T.; Gokcen, N. A.

J. Phys. Chem. 1966, 70, 2394-2399.

VARIABLES:

T/K: 262.02 - 303.16
Ar P/kPa: 36.29 - 193.33
(0.3582 - 1.908 atm)

PREPARED BY:

P. L. Long
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	P/Atm	Henry's Constant $K \times 10^4$	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
262.02	0.7110	8.69	0.618		
	1.2670	8.81	1.116		
	1.5162	8.76	1.328		
	1.8037	8.79	1.585		
	1.908	8.82	1.683		
	1.0		0.877	0.324	0.311
273.15	0.3582	9.05	0.324		
	0.5702	9.03	0.515		
	0.6879	9.14	0.629		
	0.9366	9.08	0.850		
	1.8425	9.10	1.676		
	1.0		0.908	0.330	0.330
298.15	0.3801	9.92	0.377		
	0.4158	9.81	0.408		
	0.4897	9.80	0.480		
	0.6340	9.81	0.622		
	0.8037	9.88	0.794		
	0.9912	9.81	0.972		
	1.1053	9.85	1.089		
	1.0		0.984	0.344	0.376
303.16	0.4470	9.89	0.442		
	0.5912	9.90	0.585		
	1.0		0.989	0.343	0.381

The solubility values at 1.0 atm argon pressure were calculated by the compiler from the average Henry's constant.

The authors define the Henry's constant, $K/\text{atm}^{-1} = X_1/P$.

Smoothed Data: Mole Fraction solubility at 1.0 atm argon pressure.

$\Delta G^\circ/\text{J mol}^{-1} = -RT \ln X_1 = 1999.5 + 50.900\ T$

Std. Dev. $\Delta G^\circ = 8.9$, Coef. Corr. = 0.9999

$\Delta H^\circ/\text{J mol}^{-1} = 1999.5$, $\Delta S^\circ/\text{J K}^{-1}\text{ mol}^{-1} = -50.900$.

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^\circ/\text{J mol}^{-1}$
263.15	0.880	15,394
273.15	0.910	15,903
283.15	0.938	16,412
293.15	0.966	16,921
298.15	0.979	17,175
303.15	0.993	17,430

The mole fraction solubility at 1 atm argon pressure would be equal to Henry's constant.

The authors discuss the system further, but present no additional solubility data (1, 2).

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Nitrogen Oxide; N_2O_4; 10544-72-6

ORIGINAL MEASUREMENTS:

Chang, E. T.; Gokcen, N. A.

J. Phys. Chem. 1966, 70, 2394-2399.

VARIABLES:

T/K: 262.02 - 303.16
Ar P/kPa: 36.29 - 193.33
(0.3582 - 1.908 atm)

PREPARED BY:

P. L. Long
A. L. Cramer

EXPERIMENTAL VALUES:

See preceeding page.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solvent was degassed under vacuum in the previously weighed apparatus. Apparatus and degassed solvent were weighed. Gas was introduced into the apparatus at a known P and T, the liquid stirred, and the pressure observed until there was no further change. Equilibrium was established within 10 m and the P was followed for 40 m.

The apparatus was of all glass construction. It consisted of three calibrated volumes for the measurement of the gas, a container for the solvent, which was stirred with a glass enclosed magnet, and a manometer for measuring the pressure with a microslide cathetometer. The solvent container had a capacity for 100 g of solvent with a 5 ml gas space above the liquid surface. The apparatus sections were calibrated to ± 0.0002 - 3 cm^3.

SOURCE AND PURITY OF MATERIALS:

1. Argon. No source given.

2. Nitrogen Oxide. Source not given. Research grade. 99.5% min. purity. Density,

$\rho/g\ ml^{-1} = 1.4916 - 0.00226\ t/^{o}C$.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.01$
$\delta X_1/X_1 = 0.05$

REFERENCES:

1. Chang, E. T.; Gokcen, N. A.; Poston, T. M. J. Spacecr. Rockets 1969, 6, 1177.

2. Gokcen, N. A.; Chang, E. T. J. Chem. Ed. 1977, 54, 368.

COMPONENTS:

1. Argon; Ar;
2. Octamethylcyclotetrasiloxane; $C_8H_{24}O_4Si_4$; 556-67-2

ORIGINAL MEASUREMENTS:

Wilcock, R.J.; McHale, J.L.; Battino, B.; Wilhelm, E.

Fluid Phase Equilib. 1978, 2, 225-230.

VARIABLES:

T/K: 292.15 - 313.17

P/kPa: 101.325 (1 atm)

PREPARED BY:

H.L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
292.15	4.817	0.3499	0.3742
292.15	4.845	0.3519	0.3764
298.68	4.796	0.3456	0.3779
313.17	4.689	0.3321	0.3807

The solubility values were adjusted to a gas partial pressure of 101.325 kPa by Henry's law.

The Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G^\circ/\text{J mol}^{-1} = -RT \ln X_1 = -1{,}084.2 + 48.040\ T$

Std. Dev. $\Delta G^\circ = 6.5$, Coef. Corr. = 0.9999

$\Delta H^\circ/\text{J mol}^{-1} = -1.084.2$, $\Delta S^\circ/\text{J K}^{-1}\text{ mol}^{-1} = -48.040$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^\circ/\text{J mol}^{-1}$
293.15	4.827	13,000
298.15	4.791	13,240
303.15	4.757	13,480
308.15	4.723	13,720
313.15	4.692	13,961

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus is based on the design of Morrison and Billett (1), and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus and procedure are described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is applied intermittently through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass spiral tube containing the solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Inc. Minimum per cent purity 99.995.
2. Octamethylcyclotetrasiloxane. General Electric Co. Distilled, density at 298.15 K was 0.9500 g cm^{-3}.

ESTIMATED ERROR:

$\delta T/K = 0.03$

$\delta P/mmHg = 0.5$

$\delta X_1/X_1 = 0.01$

REFERENCES:

1. Morrison, T.J.; Billett, F. J. Chem. Soc. 1948, 2033.
2. Battino, R.; Evans, F.D.; Danforth, W.F. J. Am. Oil Chem. Soc. 1968, 45, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. Anal. Chem. 1971, 43, 806.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Krypton; Kr; 7439-90-9

ORIGINAL MEASUREMENTS:

Singleton, J. H.; Halsey, G. D. Jr.

J. Phys. Chem. 1954, 58, 1011 - 1017.

VARIABLES:

T/K: 77.

$(P/P^o)_{Ar}$: 0 - 0.8

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

The "solubility" of argon in bulk krypton was measured at 77 K and at 18 values of (P/P^o) of argon between 0.1 and 0.8. P^o is the vapor pressure of argon at 77 K. The results were fitted to the equation

$(P/P^o)_{Ar} = X_{Ar} \exp\{(w/kT) X_{Ar}^2\} = X_{Ar} \exp\{1.32\ X_{Ar}^2\}$ where X_{Ar} is the mole fraction solubility of argon.

The value of w/kT = 1.32 was from the average of four experiments at the lowest argon pressure. The extreme values of w/kT ranged from 1.20 to 1.60. Figure 5 in the paper compares the experimental and calculated values.

AUXILIARY INFORMATION

METHOD:

Both 3 and 11 cm^3 samples of krypton were used. The argon was"condensed" in at various pressures. The establishment of equilibrium was found to be very slow, and was incomplete in 12 hours. There is some question as to whether or not true equilibrium was attained.

Many other experiments were carried out on the absorption of agon on predeposited layers of krypton and xenon (1) on various solid surfaces.

APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

1. Argon. Air Reduction Co. 99.9 per cent argon.
2. Krypton. No information given.

ESTIMATED ERROR:

REFERENCES:

1. Singleton, J. H.; Halsey, G. D. Jr. J. Phys. Chem. 1954, 58, 330.

COMPONENTS:	EVALUATOR:
1. Argon; Ar; 7440-37-1 2. Olive Oil	H. L. Clever Department of Chemistry Emory University Atlanta, GA 30322 U. S. A. June 1979

CRITICAL EVALUATION:

The solubility of argon in olive oil at 101.325 kPa (1 atm) argon pressure was measured at temperatures of 295.15 and 310.15 K by Lawrence, Loomis, Tobias and Turpin (1), at 311.15 K by Behnke and Yarbrough (2), and at temperatures of 297.91, 307.84, 318.36 and 327.51 K by Battino, Evans and Danforth (3).

The work of Battino *et al*. appears to be the most reliable. They gave special attention to degassing and to the establishment of equilibrium in the solubility measurement. Thus the tentative values of the thermodynamics of the transfer of one mole of argon gas at 101.325 kPa to the hypothetical unit mole fraction solution and the tentative solubility values are based entirely on the data of Battino, *et al*.

The olive oil was assumed to have a molecular weight of 884 on the basis of an NMR study (1). This agrees well with the molecular weight of 885.46 of 1,2,3-propane-triyl ester of Z-9-octadecenoic acid or triolein which is assumed to be the principle component of olive oil. The density of the olive oil used by Battino, *et al*. has a density $\rho/\mathrm{g\ cm^{-3}} = 0.9152 - 0.000468t/°\mathrm{C}$.

The tentative values of the thermodynamic changes for the transfer of one mole of argon from the gas at 101.325 kPa (1 atm) to the hypothetical unit mole fraction solution are:

$$\Delta G°/\mathrm{J\ mol^{-1}} = -RT \ln X_1 = -1727.0 + 48.382\ T$$

$$\text{Std. Dev. } \Delta G° = 2.5, \quad \text{Coef. Corr.} = 0.9999$$

$$\Delta H°/\mathrm{J\ mol^{-1}} = -1727.0, \quad \Delta S°/\mathrm{J\ K^{-1}\ mol^{-1}} = -48.382$$

A table of the tentative mol fraction solubility and Gibbs energy values as a function of temperature appears below.

Table 1. The solubility of argon in olive oil. The tentative values of the mole fraction solubility at an argon partial pressure of 101.325 kPa (1 atm) and the Gibbs energy change as a function of temperature.

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G°/\mathrm{J\ mol^{-1}}$
293.15	6.03	12,456
298.15	5.96	12,698
303.15	5.89	12,940
308.15	5.83	13,182
313.15	5.77	13,424
318.15	5.71	13,666
323.15	5.65	13,908
328.15	5.59	14,150

The solubility values determined by both Lawrence, *et al*., and Behnke and Yarbrough are 5 to 8 percent higher than the tentative recommended values.

1. Lawrence, J. H.; Loomis, W. F.; Tobias, C. A.; Turpin, F. H. *J. Physiol.* 1946, *105*, 197.
2. Behnke, A. R.; Yarbrough, O. D., *Am. J. Physiol.* 1939, *126*, 409.
3. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.
4. Johnson, L. F.; Shoolery, J. N. *Anal. Chem.* 1962, *34*, 1136.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Argon; Ar; 7440-37-1 2. Olive Oil	Behnke, A. R.; Yarbrough, O. D. *Am. J. Physiol.* 1939, 126, 409 - 415.
VARIABLES: T/K: 311.15 P/kPa: 101.325 (1 atm)	PREPARED BY: P. L. Long

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
311.15	6.09	0.1395	0.1589

The mole fraction solubility and Ostwald coefficient were calculated by the compiler.

The molecular weight of olive oil was taken to be 885 and the density was calculated from the equation $\rho/\text{g cm}^{-3} = 0.9152 - 0.000468t/^{\circ}\text{C}$ for the mole fraction calculation (1).

See the evaluation sheet for the argon + olive oil system for more information.

AUXILIARY INFORMATION

METHOD:

Gas-liquid equilibrium was established at 311.15 K by bubbling argon through the olive oil.

APPARATUS/PROCEDURE:

After establishment of equilibrium the gas was extracted from the saturated solution in vacuo by repeated shaking in a Van Slyke apparatus. The procedure and calculations were similar to those developed by Van Slyke (2). Nitrogen corrections were made.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Source not given. 86 per cent argon and 14 per cent nitrogen. Free of water.
2. Olive Oil. No information given.

ESTIMATED ERROR:

REFERENCES:

1. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, 45, 830.
2. Van Slyke, D. D.; Dillon, R. T.; Margaria, R. *J. Biol. Chem.* 1934, 105, 571.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Olive Oil

ORIGINAL MEASUREMENTS:

Lawrence, J. H.; Loomis, W. F.; Tobias, C. A.; Turpin, F. H.

J. Physiol. 1946, 105, 197 - 204.

VARIABLES:

T/K: 295.15 - 310.15
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
295.15	6.5	0.15	0.16
310.15	6.1	0.14	0.16

The mole fraction solubilities and the Ostwald coefficients were calculated by the compiler.

The molecular weight of the olive oil was taken to be 885 and the density was calculated from the equation $\rho/\text{g cm}^{-3} = 0.9152 - 0.000468t/^{\circ}\text{C}$ for the mole fraction calculation (1).

See the evaluation sheet for the argon + olive oil system for more information.

AUXILIARY INFORMATION

METHOD:

Radiochemical method. No details of the method were given, but the authors state that they used an isotope of argon with a half life of 110 minutes. Possibly the isotope was argon-41.

APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

No information given.

DATA CLASS:

ESTIMATED ERROR:

$\delta\alpha/\alpha = 0.05$ (Compiler)

REFERENCES:

1. Battino, R.; Evans, F. D. Danforth, W. F. J. Am. Oil Chem. Soc. 1968, 45, 830.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Olive Oil

ORIGINAL MEASUREMENTS:

Battino, R.; Evans, F. D.; Danforth, W. F.

J. Am. Oil Chem. Soc. 1968, 45, 830-833.

VARIABLES:

T/K: 297.91 - 327.51
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
297.91	5.96	0.136_6	0.149_0
307.84	5.84	0.133_2	0.150_1
318.36	5.70	0.129_1	0.150_5
327.51	5.60	0.126_3	0.151_4

The solubility values were adjusted to a partial pressure of argon of 101.325 kPa (1 atm) by Henry's law.
The Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/\mathrm{J\ mol^{-1}} = -RT \ln X_1 = -1727.0 + 48.382\ T$

Std. Dev. $\Delta G° = 2.5$, Coef. Corr. = 0.9999

See the evaluation of the argon + olive oil system for the recommended Gibbs energy equation and smoothed solubility values.

AUXILIARY INFORMATION

METHOD: The apparatus is based on the design by Morrison and Billett (1) and the version used is a modification of the apparatus of Clever, Battino, Saylor and Gross (2).

APPARATUS/PROCEDURE: Degassing. The solvent is sprayed into an evacuated chamber of an all glass apparatus; it is stirred and heated until the pressure drops to the vapor pressure of the liquid. Solubility Determination. The degassed liquid passes in a thin film down a glass spiral tube at a total pressure of one atm of solute gas plus solvent vapor. The gas absorbed is measured in the attached buret system, and the solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Inc. 99.9995 Min. Vol % Purity.
2. Olive Oil. A. U.S.P. Fisher Scientific Co., 0.58% free fatty acid.
   B. Nutritional Biochemicals Corp. 0.30% free fatty acid. The density was measured and fitted to the equation $\rho/\mathrm{g\ cm^{-3}} = 0.9152 - 0.000468 t/C$. The average mol wt is 884 ± 45.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/\mathrm{mmHg} = 0.5$
$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Morrison, T. J.; Billett, F. J. Chem. Soc. 1948, 2033.
2. Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M. J. Phys. Chem. 1957, 61, 1078.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O: 7732-18-5
3. Gelatin

ORIGINAL MEASUREMENTS:

Shkol'nikova, R. I.

Uch. Zap. Leningr. Gos. Univ. Ser. Khim. Nauk. 1959, 18, 64 - 86.

Chem. Abstr. 1961, 55, 25443b.

VARIABLES:

T/K: 283.15 - 313.15
P/kPa: 101.325
Gelatin/wt %: 1 - 10

PREPARED BY:

A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Gelatin/ 1 wt %		Gelatin/ 5 wt %		Gelatin/ 10 wt %	
	Bunsen Coefficient $\alpha \times 10^3$	Ostwald Coefficient $L \times 10^3$	Bunsen Coefficient $\alpha \times 10^3$	Ostwald Coefficient $L \times 10^3$	Bunsen Coefficient $\alpha \times 10^3$	Ostwald Coefficient $L \times 10^3$
283.15	33.1	34.3	28.4	29.5	24.8	25.7
288.15	29.4	31.0	25.9	26.9	22.2	23.4
293.15	25.2	27.0	23.2	25.0	19.6	21.1
298.15	22.2	24.2	20.4	22.3	17.3	18.9
303.15	19.4	21.5	17.2	19.0	15.3	17.0
308.15	16.2	18.3	14.1	15.9	13.1	14.8
313.15	13.6	15.6	12.8	14.7	10.9	12.5

The enthalpies of solution from the temperature coefficient of the Bunsen coefficient are 2110 cal mol^{-1} in water, and 5210, 4670, and 4830 cal mol^{-1} for the 1, 5, and 10 wt % gelatin solution, respectively.

The values for the solubility of argon in water were not given in the paper.

AUXILIARY INFORMATION

METHOD:

SOURCE AND PURITY OF MATERIALS:

1. Argon. 99.9 per cent Ar, 0.1 per cent N_2.

APPARATUS/PROCEDURE:

The apparatus and procedure were modified Lannung (1).

ESTIMATED ERROR:

REFERENCES:

1. Lannung, A.
J. Am. Chem. Soc. 1930, 52, 68.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Ovalbumin

ORIGINAL MEASUREMENTS:

Shkol'nikova, R. I.

Uch. Zap. Leningr. Gos. Univ., Ser. Khim. Nauk. 1959, Nr. 18, 64 - 86.

Chem. Abstr. 1961, *55*, 25443b.

VARIABLES:

T/K: 283. 15 - 313.15
P/kPa: 101.325 (1 atm)
Ovalbumin/Wt %: 0.575 - 2.92

PREPARED BY:

A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Ovalbumin/0.575 %		Ovalbumin/1.15 %		Ovalbumin/2.92 %	
	Bunsen Coefficient $\alpha \times 10^3$	Ostwald Coefficient $L \times 10^3$	Bunsen Coefficient $\alpha \times 10^3$	Ostwald Coefficient $L \times 10^3$	Bunsen Coefficient $\alpha \times 10^3$	Ostwald Coefficient $L \times 10^3$
283.15	36.4	38.1	33.2	34.4	30.8	31.9
288.15	34.9	36.8	31.0	32.7	28.1	29.6
293.15	32.0	34.3	30.9	31.1	27.7	29.7
298.15	28.4	31.0	27.1	29.6	25.2	27.5
303.15	26.5	29.4	24.1	26.7	20.9	23.2
308.15	25.3	28.5	22.3	25.2	19.2	21.6
313.15	23.4	26.8	21.2	24.3	16.7	19.1

The values of the solubility of argon in water are not given in the paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Modifications of the apparatus and procedure of Lannung (1) are used.

SOURCE AND PURITY OF MATERIALS:

1. Argon 99.9 percent argon, and 0.1 percent nitrogen.

ESTIMATED ERROR:

REFERENCES:

1. Lannung, A.
   J. Am. Chem. Soc. 1930, *52*, 68.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Water; H_2O; 7732-18-5

3. Serum Albumin

ORIGINAL MEASUREMENTS:

Shkol'nikova, R. I.

Uch. Zap. Leningr. Gos. Univ. Ser. Khim. Nauk. 1959, Nr. 18, 64-86

Chem. Abstr. 1961, 55, 25443b.

VARIABLES:

T/K: 283.15 - 313.15
P/kPa: 101.325 (1 atm)
Serum Albumin/Wt %: 0.575 - 1.99

PREPARED BY:

A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Bunsen Coefficient, $\alpha \times 10^3$			
	0.575 wt %	1.15 wt %	1.68 wt %	1.99 wt %
283.15	32.2	29.4	26.5	24.4
288.15	28.9	27.3	24.8	21.8
293.15	28.2	24.2	21.1	19.4
298.15	25.1	20.9	19.2	18.0
303.15	22.3	18.4	14.0	12.8
308.15	20.9	16.1	13.5	12.1
313.15	19.4	15.1	12.4	11.0

T/K	Ostwald Oceefficient, $L \times 10^3$			
	0.575 wt %	1.15 wt %	1.68 wt %	1.99 wt %
283.15	33.4	30.4	27.5	25.3
288.15	30.5	28.8	26.2	23.0
293.15	30.2	26.0	22.6	20.8
298.15	27.4	22.8	20.9	19.7
303.15	24.7	20.4	15.5	14.2
308.15	23.6	18.2	15.2	13.6
313.15	22.2	17.3	14.2	12.6

The enthalpies of solution of argon, calculated from the temperature coefficient of the Bunsen coefficient, are 2110 cal mol^{-1} in water, and 3410, 4340, 5270, and 6070 cal mol^{-1} for 0.575, 1.115, 1.68, and 1.99 wt % serum albumin solutions, respectively.
The solubility of argon in water is not given in the paper.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Modifications of the apparatus and procedure of Lannung (1) are used.

SOURCE AND PURITY OF MATERIALS:

1. Argon. 99.9 percent argon, and 0.1 percent nitrogen.

ESTIMATED ERROR:

REFERENCES:

1. Lannung, A.
J. Am. Chem. Soc. 1930, 52, 68.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Benzene; C_6H_6; 71-43-2
3. Cephalin

ORIGINAL MEASUREMENTS:

Byrne, J. E.; Battino, R.;
Danforth, W. F.

J. Chem. Thermodyn. 1974, 6, 245-250.

VARIABLES:

T/K: 310.65
Total P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mass Fraction Cephalin W_3	Ostwald Coefficient L	"Salting Out" Parameter $k = (1/W_3) \log (L_o/L_w)$
310.64	0.0	0.2545	
310.69	0.0	0.2544	
310.61	0.1995	0.229	
310.62	0.1995	0.227	0.24 ± 0.05
310.65	1.0	0.146*	

*Extrapolated argon solubility in hypothetical liquid cephalin.

L_o and L_w are the argon Ostwald coefficients in benzene and in the benzene + cephalin solution, respectively.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid nitrogen trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Inc. 99.995 per cent.
2. Benzene. J. T. Baker Analyzed Reagent Grade. 99.9 mol per cent, thiophene free.
3. Cephalin. Nutritional Biochemicals Corp. Homostatic phosphatide obtained from bovine brain tissue, used as received.

ESTIMATED ERROR:

$\delta T/K = 0.01$
$\delta P/mmHg = 0.5$
$\delta L_o/L_o = 0.01$
$\delta L_w/L_w = 0.02$

REFERENCES:

1. Morrison, T.J.; Billett, F.
J. Chem. Soc. 1948, 2033.
2. Battino, R.; Evans, F.D.; Danforth, W.F.
J. Am. Oil Chem. Soc. 1968, 45, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E.
Anal. Chem. 1971, 43, 806.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Benzene; C_6H_6; 71-43-2
3. Cholest-5-en-3β-ol or Cholesterol; $C_{27}H_{46}O$; 57-88-5

ORIGINAL MEASUREMENTS:

Byrne, J. E.; Battino, R.; Danforth, W. F.

J. Chem. Thermodyn. 1974, *6*, 245-250.

VARIABLES:

T/K: 310.65
P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mass Fraction Cholesterol W_3	Ostwald Coefficient L	"Salting Out" Parameter $k = (1/W_3) \log (L_o/L_w)$
310.64	0.0	0.2545	-
310.69	0.0	0.2544	
310.62	0.0525	0.251	
310.62	0.0521	0.247	
310.63	0.0521	0.252	0.15 ± 0.16
310.62	0.1065	0.241	
310.62	0.1065	0.237	0.25 ± 0.09
310.65	1.0	0.143^*	

*Extrapolated argon solubility in hypothetical liquid choleterol.

L_o and L_w are the argon Ostwald coefficients in benzene and in the benzene + cholesterol solution, respectively.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid nitrogen trap until the permament gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Inc. 99.995 per cent.
2. Benzene. J. T. Baker Analyzed Reagent Grade. 99.9 mol per cent, thiophene free.
3. Cholesterol. Source not given. Recrytalized from benzene.

ESTIMATED ERROR:

$\delta T/K = 0.01$
$\delta P/mmHg = 0.5$
$\delta L_o/L_o = 0.01$
$\delta L_w/L_w = 0.02$

REFERENCES:

1. Morrison, T.J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Battino, R.; Evans, F.D.; Danforth, W.F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Benzene; C_6H_6; 71-43-2
3. Lecithin

ORIGINAL MEASUREMENTS:

Byrne, J. E.; Battino, R.; Danforth, W. F.

J. Chem. Thermodyn. 1974, *6*, 245-250.

VARIABLES:

T/K: 310.65
Total P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mass Fraction Lecithin W_3	Ostwald Coefficient L	"Salting Out" Parameter $k = (1/W_3) \log (L_o/L_w)$
310.64	0.0	0.2545	
310.69	0.0	0.2544	
310.64	0.2004	0.223	
310.65	0.2004	0.228	0.26 ± 0.05
310.65	1.0	0.140*	

*Extrapolated argon solubility in hypothetical liquid lecithin.

L_o and L_w are the argon Ostwald coefficients in benzene and in the benzene + lecithin solution, respectively.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid nitrogen trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Matheson Co., Inc. 99.995 per cent.
2. Benzene. J. T. Baker Analyzed Reagent Grade. 99.9 mol per cent, thiophene free.
3. Lecithin. Nutritional Biochemicals Corp. Vegetable source, about 95 per cent, used as receieved.

ESTIMATED ERROR:

$\delta T/K = 0.01$
$\delta P/mmHg = 0.5$
$\delta L_o/L_o = 0.01$
$\delta L_w/L_w = 0.02$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033
2. Battino, R.; Evans, F.D.; Danforth, W.F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Argon; Ar; 7440-37-1 2. Eel Blood	Steen, J. B. Acta Physiol. Scand. 1963, 58, 124 - 137.
VARIABLES: T/K: 279.65 P/kPa: 101.325 (1 atm)	**PREPARED BY:** A. L. Cramer

EXPERIMENTAL VALUES:

T/K	pH Range	Number of Determinations	Volume per cent Argon* Range	Volume per cent Argon* Average
279.65	6.5 -∿7.9	6	3.70 - 3.73	3.72
	∿7.9 - 8.5	8	3.89 - 4.01	3.93

*Volume per cent argon at 1 atm argon.

AUXILIARY INFORMATION

METHOD:

Blood equilibrated with pure argon or with argon + oxygen mixtures. A tonometer was constructed. The gas was presaturated with water vapor by bubbling through a isotonic NaCl solution. The content of N_2 and Ar was estimated by the method of Edwards, Scholander, and Roughton (1, 2).

APPARATUS/PROCEDURE:

The normal pH of eel blood is 7.5 for freshly caught individuals, and it is around 8.5 for eels kept in fresh water about one month.

The pH of the eel blood was lowered by the addition of lactic acid. At a pH of 7.5 - 7.7 there is a sudden significant decrease in the solubility of both argon and nitrogen. See Fig 7 in the original paper.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Purified grade.
2. Eel Blood. Blood from female eels kept in running fresh water before heart puncture.

ESTIMATED ERROR:

$\delta T/K = 1$

REFERENCES:

1. Roughton, F. J. W.; Scholander, P.F. J. Biol. Chem. 1943, 148, 541, 573.
2. Edwards, G. A.; Scholander, P. F. Roughton, F. J. W. J. Biol. Chem. 1943, 148, 565.

ARGON SOLUBILITIES ABOVE 200 kPa (2 BAR)

General Remarks for High Pressure Solubility Studies on Mixtures Containing Argon

C. L. Young, August 1978

In view of the number of studies on the solubility of argon in liquids at or near atmospheric pressure, the relatively low cost and widespread availability of argon, it is surprising that there are so few detailed studies of the solubility of argon in liquids at high pressure. Almost half of the systems covered in this section were studied nearly forty years ago and then only at one or two temperatures and one or two pressures. It is only in a very few cases, possible to give a critical evaluation of the available data.

All the data of Sisskind and Kasarnowsky (1,2) must be classified as tentative, but it should be pointed out that this classification is based on the authors' claims regarding precision and not on any direct comparison with other workers' data. It is possible to compare Sisskind and Kasarnowsky (1,2) results with the data at lower pressures (atmospheric) of other workers, assuming the mole fraction solubility is a linear function of pressure. Such comparisons would indicate that Sisskind and Kasarnowsky data are probably too large; however, in view of the nature of the assumption involved, this conclusion should be treated with caution.

Argon + Carbon Tetrachloride
Argon + n-Octane
Argon + 2,2,4-Trimethylpentane
Argon + Tetradecafluoroheptane

These systems have been studied by Graham and Weale (3) and are classified as tentative on the basis of other systems reported in the original publication where comparison with other data is possible. There appears to be no other high pressure data on these systems.

Argon + Chlorodifluoromethane

The data of Nohka *et al.* (4) appear to be self-consistent and in the absence of evidence to the contrary appear to be reasonably accurate. The data are therefore classified as tentative.

Argon + Carbon Dioxide

There are two sets of data (5,6) on this system, both from the same group. In the absence of any other data with which these results can be compared, we classify them as tentative.

Argon + Carbon Monoxide

The data of Christiansen *et al.* (7) are classified as tentative. Other data from this group appears to be of good accuracy where comparison with different workers is possible.

Argon + Ethane

The two sets of data on this system cover different ranges of temperature and pressure so that comparison is difficult. It appears that the mole fraction solubility data of Eckert and Prausnitz (8) extrapolated to 115.5 K is slightly greater than that of Elshayal and Lu (9) at that temperature.

Argon + Propene

This system has been studied by Orobinsky *et al.* (10) and their results are classified as tentative. There are no other data with which to compare the results either on the same system or closely related systems.

Argon + 2,2-Dimethylpropane

This system has been studied by Rogers and Prausnitz (11) and their data are classified as tentative.

Argon + Hexane

This system has been studied by Baranovich *et al.* (12) at pressures up to 7 bar. There are no other data with which to compare their results but in view of the good agreement between these workers' results and other published data for the system nitrogen + n-octane, the present results are likely to be of reasonable accuracy.

Argon + Propylene carbonate
Argon + N-methyl-2-pyrrolidinone
Argon + Glycerol triacetate
Argon + Tributyl phosphate

These four systems have been studied by Shakhova and Zubchenko (12) and are classified as tentative. This study and several others have been carried out by these workers on apparatus capable of good accuracy.

Argon + Benzene
Argon + Toluene

These two systems have been studied by Gorodetskii, Skurat and Tal'roze (14) who observed a linear relationship between mole fraction of argon in the liquid phase and pressure. Their data are broadly consistent with the data at low pressure (one atmosphere) but because of the presentation in small graphical form the data are rejected.

References

1. Sisskind, B.; Kasarnowsky, I. *Z. Anorg. Chem.* 1933, *214*, 385.
2. Sisskind, B.; Kasarnowsky, I. *Z. Anorg. Chem.* 1931, *200*, 279.
3. Graham, E. B.; Weale, K. E. *Progr. Internat. Res. Thermodynamic and Transport Properties, Symposium on Thermophysical Properties Princeton* 1962, 153.
4. Nohka, J.; Sarashina, E.; Arai, Y.; Saito, S. *J. Chem. Engng. Japan* 1973, *6*, 10.
5. Sarashina, E.; Arai, Y.; Saito, S. *J. Chem. Engng. Japan* 1971, *4*, 379.

6. Kaminishi, G.; Arai, Y.; Saito, S. *J. Chem. Engng. Japan* 1968, *1*, 109.

7. Christiansen, L. J.; Fredenslund, A.; Mollerup, J. *Cryogenics* 1973, *13*, 405.

8. Eckert, C. A.; Prausnitz, J. M. *Am. Inst. Chem. Eng. J.* 1965, *11*, 886.

9. Elshayal, I. M.; Lu, B. C.-Y. *Cryogenics* 1971, *11*, 285.

10. Orobinsky, N. A.; Blagoi, Yu. P.; Semyannikova, E. L. *Ukrain. Fiz. Zhur.* 1968, *13*, 372.

11. Rogers, B. L.; Prausnitz, J. M. *J. Chem. Thermodynamics* 1971, *3*, 211.

12. Baranovich, Z. N.; Bogdanova, L. P.; Smirnova, A. M. *Zhur. Prikl. Khim.* 1969, *42*, 1393.

13. Shakhova, S. F.; Zubchenko, Yu. P. *Khim. Prom.* 1973, *49*, 595.

14. Gorodetskii, I. G.; Skurat, V. E.; Tal'roze, V. L. *Zhur. Fiz. Khim.* 1970, *44*, 1852.

COMPONENTS:	EVALUATOR:
1. Argon; Ar; [7440-37-1] 2. Water; H_2O; [7732-18-5]	Colin L. Young, School of Chemistry, University of Melbourne, Parkville, Victoria 3052, AUSTRALIA. July, 1978.

CRITICAL EVALUATION:

The solubility of argon in water at high pressures does not appear to have been studied in great detail. Namoit and Bondereva (1) are reported to have studied this system, but we have been unable to obtain details of this work. Lentz and Franck (2) made a study to establish the existence of gas-gas immiscibility and presented data in a graphical form. Tskilis and Prokhorov (3) have also made a study to establish details of gas-gas equilibria in this system at pressures up to 4×10^3 bar and have presented their data in a small graphical form.

The data of Sisskind and Kasarnowsky (4) appear to be the only results which are presented numerically and are therefore classified as tentative.

References

1. Namoit, A. Yu.; Bondereva, M. M. *Trudy Vses Neftegaz. Nauch.-Issled. Inst.* 1962, *No. 34*, 210.
2. Lentz, H.; Franck, E. U. *Ber. Bunsenges. Phys. Chem.* 1969, *73*, 28.
3. Tsiklis, D. S.; Prokhorov, V. M. *Zhur. Fiz. Khim.* 1966, *40*, 2335.
4. Sisskind, B.; Kasarnowsky, I. *Z. Anorg. Chem.* 1931, *200*, 279.

ADDED NOTE: Potter and Clynne (5) Have used a new method to measure the solubility of argon in water at moderate pressures (gas fugacities from 3.515 to 29.676 x 10^5Pa) over the 298 to 561 K temperature range. Their experimental values are given on page 258. Their results are compared with the recommended 101.325 kPa argon partial pressure solubilities from 273 to 353 K on pages 5 - 7.

5. Potter, R. W. II; Clynne, M. A. *J. Soln. Chem.* 1978, *7*, 837.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Water; H_2O; 7732-18-5

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I.,
Z. Anorg. Chem., 1931, *200*, 279.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}
273.35	25.3	0.001037
	50.7	0.002024
	76.0	0.002809
	101.3	0.003484
	126.7	0.004049

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Details in source. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent nitrogen and 0.1 per cent oxygen.
2. No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{Ar} = \pm 0.5\%$ (estimated by compiler).

REFERENCES:

COMPONENTS:

1. Argon; Ar; [7440-37-1]

2. Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Potter, R.W.; Clynne, M.A.

J. Soln. Chem. 1978, *7*, 837-44.

VARIABLES:

Temperature, pressure (fugacity)

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Fugacity,* f /10^5Pa	10^5 x Mole fraction of argon in liquid, x_{Ar} x 10^5	T/K	Fugacity,* f /10^5Pa	10^5 x Mole fraction of argon in liquid, x_{Ar} x 10^5
298.18	29.676	73.7	323.16	5.483	10.4
298.25	8.082	20.1	323.15	4.968	9.4
298.16	6.231	15.5	338.25	5.158	9.5
298.26	3.823	9.5	353.15	5.702	10.5
303.19	3.718	8.5	364.26	5.142	9.5
303.24	3.915	9.0	365.50	5.135	9.4
303.25	4.038	9.2	398.85	5.748	10.7
308.16	4.674	10.0	399.03	5.344	10.0
308.15	4.880	10.5	495.80	3.515	9.1
308.14	4.405	9.5	506.55	5.170	14.0
313.22	4.406	9.0	540.42	4.635	18.0
313.14	5.450	11.0	561.12	3.960	20.9
313.20	4.933	9.9			

* No values of pressure given in original paper but data given for fugacity, f, where

$$\ln f/P = -\int_0^P \frac{1-PV/RT}{P}\,dP$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

High pressure pvT cell. Vessel filled with gas and water forced into cell with displacement pump. Bubble point determined from plot of pressure against volume of water added.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta f/x = \pm 0.3\%$ up to 420 K, ±0.5 up to 470 K, ±1.0% up to 520 K, ±2.0% above 520 K.

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. Sulfuric acid monododecyl ester sodium salt (sodium dodecyl sulfate or SDS); $C_{12}H_{26}O_4S.Na$; 151-21-3

ORIGINAL MEASUREMENTS:

Matheson, I. B. C.; King, A. D.

J. Coll. Interface Sci. 1978, 66, 464 - 469.

VARIABLES:

T/K: 298.15
P/kPa: 303.4 - 903.2 (44.0-131.0 psig)
SDS/mol kg^{-1} H_2O: 0 - 0.300

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Sulfuric acid monodecyl ester sodium salt mol kg^{-1} H_2O	Pressure pounds per square inch, gauge	Volume gas evolved ml	Ambient Pressure mmHg	Ambient Temperature °C	Henry's constant K x 10^3 mol Ar kg^{-1} H_2O atm^{-1}
298.15	0	44.0	11.8	749.7	20.1	
		73.2	19.2	748.9	20.9	
		90.0	22.9	752.2	21.1	
		109.0	27.9	746.6	22.5	
		131.0	33.0	750.5	19.7	1.51±0.03
	0.100	66.6	18.6	757.3	21.9	
		84.0	23.7	754.8	22.6	
		130.0	35.1	756.7	22.0	1.63±0.03
	0.200	59.8	18.3	748.0	23.5	
		79.8	24.0	747.3	23.7	
		120.0	36.1	746.8	24.0	1.74±0.02
	0.300	53.5	17.0	743.9	22.5	
		74.4	23.6	748.5	21.1	
		118.0	36.4	753.3	22.6	1.82±0.02

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a jacketed thermostated thick-walled cylindrical brass bomb which rests on a variable speed magnetic stirrer. An inlet line to the bomb is connected to a gas manifold, and an exit line is connected to a Warburg manometer. Bourden gauges are used to record the pressure.

The solution, consisting of 100 g of water and the colloidal electrolyte, is contained in a glass liner inside of the bomb. The solution is degassed by evacuation to just above water vapor pressure and then stirring for several hours. The gas is introduced over the solution at the desired pressure and the solution is stirred for a minimum of five hours.

The gas is vented to atmospheric pressure. The gas from the supersaturated solution is collected in the Warburg manometer and its volume measured at atmospheric pressure and ambient temperature. Corrections for gas lost during venting and thermal equilibration and for water vapor pressure are made.

The solubility is reported as Henry's constant, K/mol gas kg^{-1} water atm^{-1} = gas molality/pressure, m/p.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Source not given. Chemically pure or equivalent of 99.5 mol per cent purity or better.
2. Water. Laboratory distilled.
3. Sulfuric acid monododecyl ester sodium salt. Aldrich Chemical Co., Inc. Recrystallized from ethanol and dried *in vacuo*.

ESTIMATED ERROR:

$\delta K/K = 0.02$

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Water; H_2O; 7732-18-5
3. N,N,N-Trimethyl-1-hexadecanaminium Bromide (Cetyl trimethylammonium bromide or CTAB); $C_{19}H_{42}N.Br$; 57-09-0

ORIGINAL MEASUREMENTS:

Matheson, I. B. C.; King. A. D.

J. Coll. Interface Sci. 1978, 66, 464 - 469.

VARIABLES:

T/K: 298.15
P/kPa: 186.8 - 813.6(27.1-118.0 psig)
CTAB/mol kg^{-1} H_2O: 0 - 0.300

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	1-Hexadecanaminium,N,N,N-trimethyl ammonium bromide mol kg^{-1} H_2O	Pressure pounds per square inch, gauge	Volume gas evolved ml	Ambient Pressure mmHg	Ambient Temperature °C	Henry's constant K x 10^3 mol Ar kg^{-1} H_2O atm^{-1}
298.15	0	44.0	11.8	749.7	20.1	
		73.2	19.2	748.9	20.9	
		90.0	22.9	752.2	21.1	
		109.0	27.9	746.6	22.5	
		131.0	33.0	750.5	19.7	1.51±0.03
	0.100	27.1	7.9	746.9	25.1	
		63.8	18.1	748.1	23.5	
		68.6	19.3	750.6	23.5	
		93.1	26.3	748.8	24.8	
		118.0	32.6	747.4	23.9	1.63±0.02
	0.200	43.3	13.6	753.4	22.9	
		73.6	22.9	752.1	22.8	
		111.0	33.7	748.7	22.3	1.80±0.03
	0.300	45.3	15.8	742.0	23.2	
		78.4	26.6	746.6	23.9	
		84.9	28.8	746.5	22.6	1.97±0.02

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a jacketed thermostated thick-walled cylindrical brass bomb which rests on a variable speed magnetic stirrer. An inlet line to the bomb is connected to a gas manifold, and an exit line is connected to a Warburg manometer. Bourden gauges are used to record the pressure.

The solution, consisting of 100 g of water and the colloidal electrolyte, is contained in a glass liner inside of the bomb. The solution is degassed by evacuation to just above water vapor pressure and then stirring for several hours. The gas is introduced over the solution at the desired pressure and the solution is stirred for a minimum of five hours.

The gas is vented to atmospheric pressure. The gas from the supersaturated solution is collected in the Warburg manometer and its volume measured at atmospheric pressure and ambient temperature. Corrections for gas lost during venting and thermal equilibration and for water vapor pressure are made.

The solubility is reported as Henry's constant, K/mol gas kg^{-1} water atm^{-1} = gas molality/pressure, m/p.

SOURCE AND PURITY OF MATERIALS:

1. Argon. Source not given. Chemically pure or equivalent of 99.5 mol per cent purity or better.
2. Water. Laboratory distilled.
3. 1-Hexadecanaminium,N,N,N-trimethyl bromide. Eastman. Technical grade, recrystallized from ethyl acetate-ethanol mixture and dried *in vacuo*

ESTIMATED ERROR:

$\delta K/K = 0.02$

COMPONENTS:	EVALUATOR:
1. Argon; Ar; [7440-37-1] 2. Methane, CH_4; [74-82-8]	Colin L. Young, School of Chemistry, University of Melbourne, Parkville, Victoria 3052, AUSTRALIA. July, 1978

CRITICAL EVALUATION:

The data of Duncan and Hiza (1) and Christiansen and coworkers (2) appear to be of high accuracy, but the temperature ranges of the two sets of measurements do not overlap. These workers are known to have made accurate measurements on other systems where comparison with other workers' data is possible therefore these two sets of data (1) and (2) are classified as tentative. The results of Gravelle and Lu (3) are in essential agreement with those of Duncan and Hiza (1) though of slightly lower accuracy and are considered tentative. The results of Cheung and Wang (4) of lower accuracy than those above and are over a limited range of conditions although generally in agreement with others, so may also be regarded as tentative. The data of Miller *et al.* (5) are in agreement with previous work from the same group, but are not considered further because they are reported only at 112 K at pressure between 1 and 7 bar.

References

1. Duncan, G; Hiza, M. J. *Ind. Eng. Chem. Fund.* 1972, *11*, 38.
2. Christiansen, L. J.; Fredenslund, A.; Mollerup, J. *Cryogenics* 1973, *13*, 405.
3. Gravelle, D.; Lu, B. C.-Y. *Can. J. Chem. Eng.*, 1971, *49*, 144.
4. Cheung, H.; Wang, D. I.-J. *Ind. Eng. Chem. Fund.* 1964, *3*, 355.
5. Miller, R. C.; Kidnay, A. J.; Hiza, M. J. *Am. Inst. Chem. Engnrs. J.* 1973, *19*, 145.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Methane; CH_4; 74-82-8

ORIGINAL MEASUREMENTS:

Cheung, H. and Wang, D. I.-J., *Ing. Eng. Chem. Fund.*, 1964, *3*, 355.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}
91.6	0.161	0.0108
91.6	0.340	0.102
91.6	0.578	0.227
91.6	0.857	0.380
92.0	0.242	0.044
97.2	1.348	0.380
104.8	0.615	0.0107*
104.9	1.016	0.102
104.9	1.641	0.227
105.2	0.785	0.044
114.4	2.112	0.101
114.5	1.412	0.0106*
114.5	1.652	0.043
114.5	3.191	0.226
123.9	2.652	0.0105
123.9	3.870	0.101
124.0	3.069	0.043

* Inconsistent with other data at same temperature.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Single bulb of known volume with magnetic stirrer. Components injected from separate metering cylinders. Solvent metered into degassed bulb followed by solute injection. Temperature adjusted and stirring until total pressure constant (∿1 hr). Amounts in each phase found from volume occupied by liquid and gas phase and compositions determined from phase equilibrium relations (assuming activity coefficient of solvent = 1), using saturation pressures and virial equation of state for vapor non-ideality (ref. 1).

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta P/\text{bar} = \pm 0.001$; $\delta x_{Ar} = \pm 5\%$.

REFERENCES:

1. Prausnitz, J. M., *Amer. Inst. Chem. Eng. J.*, 1959, *5*, 3.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Methane; CH_4; 74-82-8

ORIGINAL MEASUREMENTS:

Christiansen, L. J. Fredenslund, A. and Mollerup, J., *Cryogenics*, 1973, *13*, 405.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon		T/K	P/bar	Mole fraction of argon	
		in liquid, x_{Ar}	in gas, y_{Ar}			in liquid, x_{Ar}	in gas, y_{Ar}
150.72	11.74	0.0250	0.1050	164.00	30.60	0.2680	0.4450
	12.94	0.0620	0.1900		35.14	0.3680	0.5350
	15.53	0.1430	0.3460		35.64	0.3740	0.5420
	16.96	0.1910	0.4180		38.97	0.4410	0.5900
	17.98	0.2230	0.4620		42.09	0.5050	0.6310
	20.61	0.3040	0.5630		45.05	0.5620	0.6680
	24.17	0.4140	0.6540		48.76	0.6300	0.7000
	29.77	0.5740	0.7520		50.99	0.6650	0.6960
	33.05	0.6650	0.7970	178.00	32.10	0.0240	0.0530
	38.94	0.8100	0.8740		33.09	0.0460	0.0900
	40.68	0.8500	0.8950		36.48	0.1090	0.1850
	44.16	0.9200	0.9420		39.85	0.1650	0.2530
	45.12	0.9350	0.9520		42.29	0.2040	0.2920
164.00	20.43	0.0410	0.1130		43.66	0.2270	0.3140
	22.88	0.0980	0.2220		46.29	0.2680	0.3550
	26.18	0.1750	0.3330		49.76	0.3220	0.3870
	27.36	0.1960	0.3620		49.95	0.3330	0.3760

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Recirculating vapor flow apparatus. Temperature measured with platinum resistance thermometer. Pressure measured with dead weight piston gauge. Coexisting samples analysed by gas chromatography. Details in ref. 1.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.01$; $\delta P/\text{bar} = \pm 0.01$;

$\delta x_{Ar} = \pm 0.004$; $\delta y_{Ar} = \pm 0.003$

(estimated by compiler).

REFERENCES:

1. Fredenslund, A., Mollerup, J. and Christiansen, L. J., *Cryogenics*, 1973, *13*, 414.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Methane; CH_4; 74-82-8

ORIGINAL MEASUREMENTS:

Gravelle, D., Lu, B. C.-Y.,
Can. J. Chem. Eng., 1971, *49*, 144.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	in gas, y_{Ar}	T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	in gas, y_{Ar}
115.2	1.97	0.044	0.264	123.4	6.97	0.349	0.723
	2.40	0.105	0.469		7.39	0.372	0.747
	2.48	0.117	0.493		8.17	0.433	0.791
	3.03	0.170	0.594		8.14	0.447	0.788
	3.42	0.221	0.647		8.89	0.500	0.815
	4.27	0.333	0.747		9.62	0.576	0.848
	5.17	0.435	0.818		10.05	0.599	0.865
	5.38	0.476	0.831		10.10	0.609	0.863
	5.37	0.481	0.843		10.48	0.645	0.881
	6.34	0.602	0.885		11.10	0.702	0.903
	6.27	0.615	0.863*		11.45	0.724	0.913
	6.62	0.656	0.887		11.96	0.768	0.923
	6.59	0.658	0.896		12.96	0.858	0.954
	7.14	0.708	0.924		13.03	0.862	0.955
	7.09	0.725	0.923		13.03	0.867	0.957
	7.16	0.729	0.924		13.13	0.874	0.960
	7.72	0.802	0.947		13.20	0.880	0.962
	7.78	0.807	0.948	137.1	6.58	0.040	0.169
	8.14	0.861	0.962		7.38	0.076	0.281
	8.25	0.876	0.962		8.24	0.114	0.371
	8.56	0.916	0.978		9.93	0.194	0.497
	8.69	0.931	0.983		11.86	0.292	0.615
	8.85	0.953	0.986		11.91	0.295	0.613
123.4	3.52	0.062	0.302		15.69	0.470	0.751
	6.48	0.290	0.677		18.26	0.597	0.819

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Forced recirculation cell using external, room temperature electromagnetic pump with vapor sample in recirculation loop and liquid sample withdrawn from 100 ml Jerguson cell. See ref. 1 for details. Evacuated cell charged with heavier component, then lighter component. Recirculation started after thermal equilibrium reached and run for 2 hours. Vapor sample taken from tube in recirculation loop: liquid sample withdrawn at slow rate while pressures kept constant by system volume reduction.

SOURCE AND PURITY OF MATERIALS:

1. Linde sample, purity 99.995 mole per cent.
2. Matheson sample, purity 99.99 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$; $\delta P/\text{bar} = \pm 0.08$;

δx_{Ar}, $\delta y_{Ar} = \pm 0.007$.

REFERENCES:

1. Chang, S. D., Lu, B. C.-Y., *Chem. Eng. Prog. Symp. Ser.*, 1967, *63*, #81, 18.

COMPONENTS:

(1) Argon; Ar; 7440-37-1

(2) Methane; CH_4; 74-82-8

ORIGINAL MEASUREMENTS:

Gravelle, D., Lu, B. C.-Y., *Can. J. Eng.*, 1971, *49*, 144.

VARIABLES:

Temperature, pressure

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Mole fraction of argon in gas, y_{Ar}	T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Mole fraction of argon in gas, y_{Ar}
123.75	5.58	-	0.6299	123.75	13.31	0.8810	-
	6.32	0.2980	-	126.00	5.34	0.1689	-
	7.23	0.3715	-		5.88	0.2071	-
	7.52	-	0.7604		7.17	0.3024	-
	8.58	0.4882	-		7.19	0.3031	-
	9.67	0.5814	0.8549		8.55	0.4050	-
	11.13	0.7021	-		9.48	0.4729	-
	11.18	0.7063	-		10.12	0.5209	-
	11.46	-	0.9109		11.45	0.6234	-
	11.89	0.7682	-		11.70	0.6417	-
	12.67	0.8279	-				

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Methane; CH_4; 74-82-8

ORIGINAL MEASUREMENTS:

Duncan, A. G. and Hiza, M. J.,
Ind. Eng. Chem. Fund., 1972, *11*, 38.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	in gas, y_{Ar}	T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	in gas, y_{Ar}
105.00	1.82	0.2623	-	112.00	3.75	0.3856	-
	2.19	0.3458	-		4.53	0.5118	-
	2.43	0.4066	-		5.28	0.6353	-
	2.62	0.4569	-		5.59	0.6853	-
	2.65	0.4609	-	115.75	2.47	-	0.4797
	2.86	0.5154	-		3.06	0.1824	-
	3.04	0.5668	-		3.54	-	0.6743
	3.23	0.6230	-		3.92	0.2844	-
	3.40	0.6691	-		4.70	0.3807	-
	3.59	0.7218	-		4.96	0.4143	-
109.00	1.84	0.1603	-		5.04	-	0.8114
	2.41	0.2592	-		5.89	0.5295	-
	2.51	0.2859	-		6.53	-	0.8925
	3.04	0.3729	-		6.93	0.6666	-
	3.09	0.3848	-		7.58	0.7548	-
	3.65	0.4949	-		7.99	0.8079	-
	3.78	0.5239	-	119.75	3.80	0.1722	-
	3.93	0.5548	-		5.11	0.3014	-
	4.25	0.6217	-		6.10	0.4000	-
	4.40	0.6475	-		7.21	0.5175	-
	4.64	0.6943	-		8.20	0.6160	-
	4.69	0.7122	-		9.14	0.7144	-
	4.86	0.7461	-	123.75	4.26	-	0.4670
112.00	2.24	0.1582	-		4.54	0.15424	-
	2.93	0.2571	-		5.32	0.2150	-

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Equilibrium cell with room temperature vapor recirculation pump. Liquid samples withdrawn directly, vapor samples isolated in vapor loop and analysed by gas chromatography. See ref. 1, for details.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.01$; $\delta P/\text{bar} = \pm 0.02$;

$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Duncan, A. G. and Hiza, M. J.,
Adv. Cryog. Eng., 1970, *15*, 42.

COMPONENTS:

(1) Argon; Ar; 7440-37-1

(2) Methane; CH_4; 74-82-8

ORIGINAL MEASUREMENTS:

Duncan, A. G. and Hiza, M. J., *Ind. Eng. Chem. Fund.*, 1972, *11*, 38.

VARIABLES:

Temperature, pressure

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Mole fraction of argon in gas, y_{Ar}	T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Mole fraction of argon in gas, y_{Ar}
137.1	20.23	0.685	0.862	137.1	24.68	0.870	0.944
	22.16	0.768	0.899		26.09	0.927	0.967
	23.83	0.836	0.930				

* Inconsistent with other data at same temperature.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Argon; Ar; [7440-37-1]

2. Methane; CH_4; [74-82-8]

ORIGINAL MEASUREMENTS:

Miller, R. C.; Kidnay, A. J.; Hiza, M. J., *Am. Inst. Chem. Engnrs. J.*, 1973, *19*, 145.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid x_{Ar}	in vapor y_{Ar}
112.00	1.542	-	0.3588
	1.545	0.0690	-
	1.752	0.0944	0.4297
	3.135	-	0.7377
	3.143	0.2945	-
	3.209	0.3081	0.7629
	4.500	-	0.8535
	4.452	0.4946	-
	5.613	0.6895	0.9165
	6.880	0.8837	0.9724

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Recirculating vapor flow apparatus. Temperature measured with platinum resistance thermometer. Pressure measured with Bourdon gauge. Gas and liquid samples analysed by gas chromatography. Details in source and refs. 1 and 2.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta P/\text{bar} = \pm 0.02$;

δx_{Ar}, $\delta y_{Ar} = \pm 1\%$.

REFERENCES:

1. Kidnay, A.J.; Miller, R.C.; Hiza, M.J., *Ind. Eng. Chem. Fundam.*, 1971, *10*, 459.
2. Miller, R.C.; Kidnay, A.J.; Hiza, M.J., *J. Chem. Thermodynamics*, 1972, *4*, 807.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Ethane; C_2H_6; 74-84-0

ORIGINAL MEASUREMENTS:

Elshayal, I. M. and Lu, B. C.-Y.,
Cryogenics, 1971, *11*, 285.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}
115.5	1.696	0.0690	115.5	6.026	0.3969
	1.737	0.0710		6.267	0.4259
	1.737	0.0712		6.502	0.4577
	2.048	0.0926		6.798	0.5046
	2.048	0.0928		6.957	0.5355
	2.124	0.0980		7.274	0.6120
	2.330	0.1119		7.453	0.6638
	2.351	0.1135		7.570	0.6978
	2.482	0.1222		7.639	0.7304
	2.841	0.1450		7.791	0.7581
	2.992	0.1546		7.943	0.8004
	3.337	0.1760		8.012	0.8210
	3.516	0.1873		8.019	0.8230
	3.985	0.2176		8.170	0.8619
	4.406	0.2470		8.487	0.9151
	4.875	0.2835		8.584	0.9265
	5.522	0.3422		8.901	0.9570
	5.640	0.3540		8.998	0.9654
	6.012	0.3946		9.177	0.9813

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Recirculating vapor cell using external room temperature magnetic pump. Temperature measured with two thermocouples. Pressure measured with Bourdon gauge or mercury manometer. Vapor sample taken from recirculation loop, liquid sample taken from cell at constant pressure. Samples analysed by gas solid chromatography. Details in source and ref. 1.

SOURCE AND PURITY OF MATERIALS:

1. Matheson research grade sample minimum purity 99.998 mole per cent.

2. Matheson research grade sample minimum purity 99.9 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.01$; $\delta P/\mathrm{bar} = \pm 0.1\%$;

$\delta x_{Ar} = \pm 0.001$ (estimated by compiler).

REFERENCES:

1. Chang, S. D., Lu, B. C.-Y., *Chem. Eng. Prog. Symp. Ser.*, 1967, *63*, no. 81, 18.

COMPONENTS:

1. Argon; Ar; [7440-37-1]

2. Ethane; C_2H_6; [74-84-0]

ORIGINAL MEASUREMENTS:

Eckert, C. A.; Prausnitz, J. M., *Am. Inst. Chem. Eng. J.*, 1965, *11*, 886.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	in vapor y_{Ar}
81.44	0.4104	0.312	0.999+
84.76	0.6464	0.445	0.998
90.00	1.1877	0.611	0.999
99.10	2.517	0.581	0.999+
102.98	3.365	0.499	0.999
113.52	6.908	0.660	0.998

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Recirculating vapor flow apparatus with heavy-wall glass cell. Temperature measured with thermocouple. Pressure measured with Bourdon gauge. Samples of both phases analysed by gas chromatography.

SOURCE AND PURITY OF MATERIALS:

1. Linde sample, purity 99.995 mole per cent.

2. Phillips Petroleum sample, purity 99.96 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta P/\text{bar} = \pm 0.007$ up to 2 bar, ± 0.02 above 2 bar; δx_{Ar}, δy_{Ar} $= \pm 0.005$ or better.

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Pentane; C_5H_{12}; 109-66-0

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I.,
Z. Anorg. Chem., 1931, *200*, 279.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}
273.35	25.4	0.169

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Details in source. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;
$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. 2,2-Dimethylpropane; C_5H_{12}; 463-82-1

ORIGINAL MEASUREMENTS:

Rogers, B. L. and Prausnitz, J. M., *J. Chem. Thermodynamics*, 1971, *3*, 211.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	*P*/bar	Mole fraction of argon in liquid, x_{Ar}	Mole fraction of argon in gas, y_{Ar}
323.15	11.10	2.49	58.51
	21.96	5.25	79.78
	41.92	10.50	86.37
	58.95	14.40	89.52
	74.81	19.04	90.42
	84.18	21.19	92.25
	96.58	24.54	92.40
	115.69	29.38	92.26
	130.59	32.38	92.54
	149.69	37.37	91.91
	164.10	41.06	91.66
	179.19	44.62	90.40
	200.29	49.04	89.27
	220.90	54.18	87.70
	242.54	59.43	84.15
	250.69	65.31	80.40

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Stainless steel equilibrium cell fitted with pistons which enabled sample of gas and liquid to be taken without a change in pressure. Pressure measured with floating piston gauge and temperature with four thermocouples. Cell charged with components and magnetically stirred. Samples removed and analysed using gas chromatography. Details in ref. 1.

SOURCE AND PURITY OF MATERIALS:

1. Matheson, high purity sample; purity 99.995 mole per cent.
2. Phillips Petroleum Co. Research grade sample; purity 99.97 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta P/\text{bar} = \pm 0.07$;

δx_{Ar}, δy_{Ar} = ±1%.

REFERENCES:

1. Rogers, B. L. and Prausnitz, J. M. *Ind. Eng. Chem. Fundam.*, 1970, *9*, 74.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Hexane; C_6H_{14}; 110-54-3

ORIGINAL MEASUREMENTS:

Baranovich, Z. N., Bogdanova, L. P. and Smirnova, A. M., *Zhur. Prikl. Khim.*, 1969, *42*, 1393.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}
233.15	2.0	0.000404
	3.0	0.000634
	5.1	0.001085
	7.1	0.001415
253.15	2.0	0.000339
	3.0	0.000594
	5.1	0.001038
	7.1	0.001437
273.15	2.0	0.000321
	3.0	0.000537
	5.1	0.001013
	7.1	0.001385
293.15	2.0	0.000284
	3.0	0.000472
	5.1	0.001007
	7.1	0.001444

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Static equilibrium cell fitted with agitator. Liquid composition determined by stripping and measuring gas volumetrically.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta P/\text{bar} = \pm 0.1$;

$\delta x_{Ar} = \pm 0.5 \times 10^{-5}$ (compiler's estimate).

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Octane; C_8H_{18}; 111-65-9

ORIGINAL MEASUREMENTS:

Graham, E. B. and Weale, K. E., *Progr. Internat. Res. Thermodynamic and Transport Properties, Symposium on Thermophysical Properties*, Princeton, 1962, 153.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Mole fraction of argon in gas, y_{Ar}	T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Mole fraction of argon in gas, y_{Ar}
323.15	1	0.0024	-	348.15	152.0	0.301	0.9951
	50.7	0.114	-		177.3	0.340	-
	76.0	0.163	-		202.7	0.376	0.9949
	101.3	0.209	-		228.0	0.410	-
	126.7	0.252	-		253.3	0.441	0.9942
	152.0	0.294	-		278.6	0.469	-
	177.3	0.335	-		304.0	0.496	-
	202.7	0.376	-	373.15	76.0	0.169	-
	228.0	0.411	-		126.7	0.259	-
	253.3	0.442	-		152.0	0.301	0.9900
348.15	76.0	0.169	-		202.7	0.376	0.9905
	101.3	0.215	-		253.3	0.441	-
	126.7	0.259	-		304.0	-	0.9895

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Equilibrium vessel made of beryllium copper of 2 × 10^5 mm^3 capacity attached to small sampling vessel. Pressure measured with Bourdon gauge. Magnetic stirrer in equilibrium vessel. Solvent introduced into equilibrium vessel, compressed gas admitted and equilibrated. Samples analysed by gravimetric (liquid) and volumetric (gas) techniques. Details in ref. 1.

SOURCE AND PURITY OF MATERIALS:

1. Commercial sample, 99.9 mole per cent purity.
2. Distilled and dried.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta P/bar = \pm 0.5$;

$\delta x_{Ar} = \pm 1\%$; $y_{Ar} \simeq 0.1\%$.

REFERENCES:

1. Graham, E. B., *Ph.D. Thesis, University of London*, 1958.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 2,2,4-Trimethylpentane; C_8H_{18}; 540-84-1

ORIGINAL MEASUREMENTS:

Graham, E. B. and Weale, K. E., *Progr. Internat. Res. Thermodynamic and Transport Properties, Symposium on Thermophysical Properties*, Princeton, 1962, 153.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	in gas, y_{Ar}	T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	in gas, y_{Ar}
323.15	1.0	0.0027	-	348.15	152.0	0.345	0.988
	50.7	0.126	-		177.3	0.389	-
	76.0	0.178	-		202.7	0.429	0.988
	101.3	0.228	-		228.0	0.467	-
	126.7	0.274	-		253.3	-	0.988
	152.0	0.318	0.995	373.15	1.0	0.0026	-
	177.3	0.358	-		76.0	0.192	-
	202.7	0.396	0.994		101.3	0.244	-
	228.0	0.428	-		126.7	0.295	-
	253.3	0.455	0.993		152.0	0.342	0.9815
348.15	1.0	0.0028	-		177.3	0.387	-
	50.7	0.135	-		202.7	0.430	0.9805
	76.0	0.193	-		228.0	0.470	-
	101.3	0.246	0.9875		253.3	0.510	0.979
	126.7	0.298	-				

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Equilibrium vessel made of beryllium copper of 2 × 10^5 mm^3 capacity attached to small sampling vessel. Pressure measured with Bourdon gauge. Magnetic stirrer in equilibrium vessel. Solvent introduced into equilibrium vessel, compressed gas admitted and equilibrated. Samples analysed by gravimetric (liquid) and volumetric (gas) techniques. Details in ref. 1.

SOURCE AND PURITY OF MATERIALS:

1. Commercial sample, 99.9 mole per cent purity.
2. Distilled and dried.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta P/bar = \pm 0.5$;

$\delta x_{Ar} = \pm 1\%$; $\delta y_{Ar} = \pm 0.1\%$.

REFERENCES:

1. Graham, E. B., *Ph.D. Thesis, University of London*, 1958.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Propene; C_3H_6; 115-07-1

ORIGINAL MEASUREMENTS:

Orobinsky, N. A., Blagoy, Yu. P. and Semyannikova, E. L., *Ukrain. Fiz. Zhur.*, 1968, *13*, 372.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}
100	1.39	0.060	130	15.00	0.158
	1.57	0.057		16.83	0.190
	3.07	0.120		19.66	0.290
110	3.35	0.057	140	6.50	0.045
	4.09	0.085		12.12	0.075
	4.12	0.090		15.49	0.101
	5.03	0.110		16.8	0.103
	5.05	0.107		20.0	0.148
	5.20	0.114		22.2	0.150
	5.91	0.121		30.3	0.262
	6.37	0.167		31.5	0.360
120	3.77	0.044	150	12.01	0.059
	3.86	0.048		20.5	0.106
	3.87	0.048		20.6	0.106
	7.19	0.091		21.1	0.113
	10.30	0.146		26.5	0.139
	10.49	0.1580		36.3	0.209
	11.82	0.2050		43.7	0.328
130	3.68	0.028		45.9	0.410
	6.40	0.058		46.0	0.410
	10.89	0.102		46.2	0.412
	11.67	0.106		47.1	0.460
	11.87	0.119			

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Recirculating vapor flow apparatus fitted with magnetic pump. Temperature measured with platinum resistance thermometer; pressure measured with Bourdon gauge. Samples of liquid phase analysed by gas chromatography.

SOURCE AND PURITY OF MATERIALS:

1. Sample purity 99.97 mole per cent.
2. Purified sample contained about 0.02 mole per cent nitrogen, oxygen and carbon dioxide and less than 0.5 mole per cent hydrocarbon impurity.

ESTIMATED ERROR:

$\delta T/K = \pm 0.03$; $\delta P/\text{bar} = \pm 0.4\%$; $\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Cyclohexane; C_6H_{12}; 110-82-7

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I.,
Z. Anorg. Chem., <u>1933</u>, *214*, 385.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald[†] coefficient
298.15	50.7	0.0732	0.302

[†] incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, <u>1931</u>, *200*, 279.

COMPONENTS: 1. Argon; Ar; 7440-37-1 2. Methylcyclohexane; $CH_3C_6H_{11}$; 108-87-2	ORIGINAL MEASUREMENTS: Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1933, *214*, 385.
VARIABLES:	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald[†] coefficient
298.15	50.7	0.0899	0.311

[†] incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Benzene; C_6H_6; 71-43-2

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1933, *214*, 385.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald[†] coefficient
280.15	50.7	0.0384	0.197
	101.3	0.0792	0.203
	126.7	0.0995	0.204

[†] incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

COMPONENTS: 1. Argon; Ar; 7440-37-1 2. Methylbenzene (Toluene); $C_6H_5CH_3$; 108-88-3	ORIGINAL MEASUREMENTS: Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1933, *214*, 385.
VARIABLES: Temperature, pressure	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald† coefficient
273.15	25.4	0.0232	0.200
	50.7	0.0464	0.200
	76.0	0.0745	0.214
280.15	50.7	0.0457	0.195

†incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Dimethylbenzene (Xylene); C_8H_{10}; 1330-20-7

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1933, *214*, 385.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald[†] coefficient
273.15	50.7	0.0517	0.196
	101.3	0.1114	0.211

[†] incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Methanol; CH_3OH; 67-56-1

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I.,
Z. Anorg. Chem., 1931, *200*, 279.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}
273.35	25.3	0.0137
	50.7	0.0286
	76.0	0.0417
	101.3	0.0526

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Details in source. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent nitrogen and 0.1 per cent oxygen.
2. Purity 99.8 per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;
$\delta x_{Ar} = \pm 0.5\%$ (estimated by compiler).

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Ethanol; C_2H_5OH; 64-17-5

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I.,
Z. Anorg. Chem., 1931, *200*, 279.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}
273.35	25.3	0.0192
	50.7	0.0400
	76.0	0.0556
	101.3	0.0667

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Details in source. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent nitrogen and 0.1 per cent oxygen.
2. Purity 99.8 per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{Ar} = \pm 0.5\%$ (estimated by compiler).

REFERENCES:

COMPONENTS: 1. Argon; Ar; 7440-37-1 2. 1-Propanol; C_3H_7OH; 71-23-8	ORIGINAL MEASUREMENTS: Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1933, *214*, 385.
VARIABLES:	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald[†] coefficient
273.15	50.7	0.0360	0.220

[†] incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;
$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. 1-Butanol; C_4H_9OH; 71-36-3

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I.,
Z. Anorg. Chem., 1933, *214*, 385.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald† coefficient
273.15	50.7	0.0419	0.209

†incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;
$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. 2-Butanol; C_4H_9OH; 78-92-2

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I.,
Z. Anorg. Chem., 1933, *214*, 385.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald[†] coefficient
273.15	50.7	0.0422	0.210

[†] incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/bar = \pm 0.5$;
$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I.,
Z. Anorg. Chem., 1931, *200*, 279.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 2-Methylpropanol; $C_4H_{10}O$; 78-83-1

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1933, *214*, 385.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald[†] coefficient
273.15	30.7	0.0461	0.228

[†] incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 2-Methylbutanol; $C_5H_{11}OH$; 137-32-6

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I.,
Z. Anorg. Chem., 1933, *214*, 385.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald[†] coefficient
273.15	25.4	0.0251	0.210
	50.7	0.0501	0.210

[†] incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;
$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Hexanol; $C_6H_{13}OH$; 111-27-3

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I.,
Z. Anorg. Chem., 1933, *214*, 385.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald[†] coefficient
273.15	25.4	0.0238	0.174

[†] incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample of 1-hexanol.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;
$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Octanol; $C_8H_{17}OH$; 111-87-5

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1933, *214*, 385.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald[†] coefficient
273.15	50.7	0.0562	0.163

[†] incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample of 1-octanol.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Octanol; $C_8H_{17}OH$: 29063-28-3
   (ambiguously referred to as sec-octanol)

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1933, *214*, 385.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald[†] coefficient
273.15	25.4	0.0297	0.172

[†] incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Cyclohexanol; $C_6H_{12}O$; 108-93-0

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I.,
Z. Anorg. Chem., 1933, *214*, 385.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald[†] coefficient
298.15	25.3	0.0132	0.112

[†] incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Benzenemethanol (Benzyl alcohol); $C_6H_5CH_2OH$; 100-51-6

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1933, *214*, 385.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald[†] coefficient
273.15	25.4	0.0068	0.060
	50.7	0.0136	0.060

[†] incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Diethylether, (Ethane, 1,1-oxy-bis-); $(C_2H_5)_2O$; 60-29-7

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}
273.35	25.4	0.0640

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Details in source. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Benzene, 1,1-[oxybis(methylene) bis]-; (Benzyl ether), $(C_6H_5CH_2)_2O$; 103-50-4

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I.,
Z. Anorg. Chem., 1933, *214*, 385.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald[†] coefficient
273.15	25.4	0.0287	0.068
	50.7	0.0291	0.059
	101.3	0.0607	0.072

[†] incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Benzaldehyde; C_7H_6O; 100-52-7

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I.,
Z. Anorg. Chem., 1931, *200*, 279.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}
273.35	25.4	0.0121

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Details in source. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 2-Propanone (Acetone); C_3H_6O; 67-64-1

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}
273.35	25.4	0.0289

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Details in source. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

COMPONENTS: 1. Argon; Ar; 7440-37-1 2. 2-Propanone (Acetone); C_3H_6O; 67-64-1	ORIGINAL MEASUREMENTS: Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1933, *214*, 1978.
VARIABLES: Pressure	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald† coefficient
273.15	25.4	0.0190	0.238
	50.7	0.0397	0.249
	101.3	0.0810	0.254

†incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 2-Butanone, (Methylethylketone); C_4H_8O; 78-93-3

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1933, *214*, 385.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald[†] coefficient
273.15	25.4	0.216	0.222

[†] incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{\text{Ar}} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 2-Pentanone (Methylpropylketone); $C_5H_{10}O$; 107-87-9

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1933, *214*, 385.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald[†] coefficient
273.15	50.7	0.0544	0.234

[†] incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 3-Pentanone, (Diethylketone); $C_5H_{10}O$; 96-22-0

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1933, *214*, 385.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald[†] coefficient
273.15	50.7	0.0546	0.237

[†] incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 3-Hexanone (Ethylpropylketone); $C_6H_{12}O$; 589-38-8

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1933, *214*, 385.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald[†] coefficient
273.15	50.7	0.0637	0.238

[†] incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;
$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 2-Octanone, (Methylhexylketone); $C_8H_{16}O$; 111-13-7

ORIGINAL MEASUREMENTS:

Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1933, *214*, 385.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald† coefficient
273.15	50.7	0.0660	0.193

†incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{Ar} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931. *200*, 279.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Argon; Ar; 7440-37-1 2. Cyclohexanone; $C_6H_{10}O$; 108-94-1	Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1933, *214*, 385.
VARIABLES:	**PREPARED BY:**
Temperature, pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	Ostwald[†] coefficient
273.15	50.7	0.0288	0.127
	101.3	0.0581	0.128
298.15	50.7	0.0288	0.124

[†] incorrectly called Bunsen coefficient in original paper

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Static equilibrium cell. Details in ref. 1. Liquid phase analysed by volumetric methods.

SOURCE AND PURITY OF MATERIALS:

1. Contained 3-4 per cent of nitrogen and 0.1 per cent oxygen.
2. Highest purity KAHLBAUM sample.

ESTIMATED ERROR:

$\delta T/\mathrm{K} = \pm 0.3$; $\delta P/\mathrm{bar} = \pm 0.5$;

$\delta x_{\mathrm{Ar}} = \pm 0.5\%$.

REFERENCES:

1. Sisskind, B. and Kasarnowsky, I., *Z. Anorg. Chem.*, 1931, *200*, 279.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1,3-Dioxolan-2-one, 4-methyl-, (Propylene carbonate); $C_4H_6O_3$; 108-32-7

ORIGINAL MEASUREMENTS:

Shakhova, S. F. and Zubchenko, Yu. P., *Khim. Prom.*, 1973, *49*, 595.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	α† vol/vol	T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	α† vol/vol
298.15	54.41	0.0168	4.5	323.15	94.94	0.0303	8.2
	77.51	0.0238	6.4		124.73	0.0374	10.2
	80.45	0.0241	6.5	343.15	38.30	0.0135	3.6
	82.88	0.0256	6.9		54.72	0.0190	5.1
	94.64	0.0281	7.6		68.50	0.0230	6.2
	119.16	0.0349	9.5		95.04	0.0310	8.4
323.15	39.21	0.0139	3.7		117.03	0.0352	9.6
	60.80	0.0201	5.4		121.18	0.0377	10.3
	74.58	0.0241	6.5				

α† quoted in original paper, appears to be volume of gas at T/K = 273.15 and P = 1 atmosphere adsorbed by unit volume of liquid at room temperature.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Mixture stirred by ball in rocking autoclave. Samples of liquid analysed by volumetric method. Details in ref. 1.

SOURCE AND PURITY OF MATERIALS:

1. Purity 99.9 mole per cent.
2. No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta P/\text{bar} = \pm 0.1$;

$\delta x_{Ar} = \pm 5\%$ (estimated by compiler).

REFERENCES:

1. Shakhova, S. F., Zubchenko, Yu. P. and Kaplan, L. K., *Khim. Prom.*, 1973, *5*, 108.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 1,2,3-Propanetriol, triacetate (Glycerol triacetate); $C_9H_{14}O_6$; 102-76-1

ORIGINAL MEASUREMENTS:

Shakhova, S. F. and Zubchenko, Yu. P.

Khim. Prom., 1973, *49*, 595.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	α† vol/vol
298.15	34.35	0.0303	3.7
	47.52	0.0421	5.2
	64.75	0.0535	6.7
	84.61	0.0677	8.6
	104.47	0.0793	10.2
	122.10	0.0899	11.7
323.15	31.92	0.0311	3.8
	55.93	0.0505	6.3
	60.39	0.0535	6.7
	62.21	0.0558	7.0
	73.06	0.0633	8.0
323.15	90.99	0.0742	9.5
	114.29	0.0906	11.8
	125.04	0.0996	13.1
	134.36	0.1037	13.7
343.15	31.41	0.0295	3.6
	42.05	0.0382	4.7
	72.14	0.0618	7.8
	85.82	0.0721	9.2
	101.53	0.0828	10.7
	119.16	0.0961	12.6
	134.36	0.1084	14.4

α† quoted in original paper, appears to be volume of gas at T/K = 273.15 and P = 1 atmosphere adsorbed by unit volume of liquid at room temperature.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Mixture stirred by ball in rocking autoclave. Samples of liquid analysed by volumetric method. Details in ref. 1.

SOURCE AND PURITY OF MATERIALS:

1. Purity 97.8 mole per cent.
2. No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta P/\text{bar} = \pm 0.1$;

$\delta x_{Ar} = \pm 5\%$ (estimated by compiler).

REFERENCES:

1. Shakhova, S. F., Zubchenko, Yu. P. and Kaplan, L. K., *Khim. Prom.*, 1973, *5*, 108.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Cyclohexane, undecafluoro (trifluoromethyl)-,(Tetradecafluoromethylcyclohexane); C_7F_{14}; 335-02-2

ORIGINAL MEASUREMENTS:

Graham, E. B. and Weale, K. E., *Progr. Internat. Res. Thermodynamic and Transport Properties, Symposium on Thermophysical Properties*, Princeton, 1962, 153.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/atom	Mole fraction of argon in liquid, x_{Ar}	in gas, y_{Ar}
323.15	1.0	0.0047	-
	76.0	0.266	-
	101.3	0.324	0.986
	152.0	0.424	-
	172.3	-	0.981
	202.7	0.507	-
	233.0	-	0.965
	253.3	0.569	-
	263.4	-	0.955
	329.3	0.631	-

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Equilibrium vessel made of beryllium copper of 2×10^5 mm^3 capacity attached to small sampling vessel. Pressure measured with Bourdon gauge. Magnetic stirrer in equilibrium vessel. Solvent introduced into equilibrium vessel, compressed gas admitted and equilibrated. Samples analysed by gravimetric (liquid) and volumetric (gas) techniques. Details in ref. 1.

SOURCE AND PURITY OF MATERIALS:

1. Commercial sample, 99.9 mole per cent purity.
2. Purity at least 99.5 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta P/\text{bar} = \pm 0.5\%$; $\delta x_{Ar} = \pm 1\%$; $\delta y_{Ar} \simeq 0.1\%$.

REFERENCES:

1. Graham, E. B., *Ph.D. Thesis, University of London*, 1958.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Chlorodifluoromethane; $CHClF_2$; 75-45-6

ORIGINAL MEASUREMENTS:

Nohka, J., Sarashina, E., Arai, Y. and Saito, S., *J. Chem. Engng. Japan*, 1973, *6*, 10.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	in gas, y_{Ar}
273.15	15.2	0.0249	0.660
	25.3	0.0483	0.758
	50.7	0.110	0.852
	75.2	0.171	0.872
	100.9	0.237	0.874
	122.6	0.295	0.873
	142.4	0.357	0.864
	162.8	0.421	0.842
	178.3	0.482	0.814
	187.5	0.530	0.783
	193.8	0.587	0.745
298.15	25.3	0.0343	0.495
	50.7	0.0987	0.704
	76.2	0.163	0.756
	100.9	0.234	0.776
	123.4	0.298	0.765
	141.4	0.361	0.748
298.15	147.4	0.381	0.736
	154.0	0.411	0.725
	160.5	0.445	0.704
	165.9	0.473	0.674
	169.2	0.520	0.634
323.15	25.3	0.0146	0.176
	50.7	0.0804	0.490
	75.2	0.145	0.573
	101.3	0.227	0.596
	101.8	0.231	0.596
	122.6	0.307	0.574
	130.3	0.359	0.544
	133.8	0.396	0.512
348.15	50.7	0.0492	0.197
	75.2	0.130	0.311
	88.7	0.196	0.320

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static cell fitted with magnetic stirrer. Temperature measured with liquid in glass thermometer and pressure measured with Bourdon gauge. After equilibrium established vapor and liquid samples analysed by gas chromatography. Details in refs. 1 and 2.

SOURCE AND PURITY OF MATERIALS:

1. No details given.
2. Purity better than 99.9 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta P/\text{bar} = \pm 0.1$;

δx_{Ar}, δy_{Ar} = ±1% (estimated by compiler).

REFERENCES:

1. Kaminishi, G., Arai, Y., Saito, S. and Maeda, S., *J. Chem. Engng. Japan*, 1968, *1*, 109.
2. Sarashina, E., Arai, Y. and Saito, S., *J. Chem. Engng. Japan*, 1971, *4*, 377.

COMPONENTS:

1. Argon; Ar; [7440-37-1]

2. Methane, tetrachloro-, (carbon tetrachloride); CCl_4; [56-23-5]

ORIGINAL MEASUREMENTS:

Graham, E. B.; Weale, K. E.,
Progr. Internat. Res. Thermodynamic and Transport Properties, Symposium on Thermophysical Properties,
Princeton, 1962, 153.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	in gas, y_{Ar}	T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	in gas, y_{Ar}
323.15	1.0	0.0014	-	348.15	177.3	0.204	-
	76.0	0.099	-		202.7	0.227	0.9875
	101.3	0.130	-		228.0	0.250	-
	126.7	0.160	-		243.2	-	0.988
	152.0	0.188	0.9944		253.3	0.272	-
	117.2	0.215	0.9951		278.6	0.292	-
	202.7	0.241	-	373.15	1.0	0.00135	-
	228.0	0.265	-		50.7	0.066	-
	243.2	-	0.9944		76.0	0.095	-
	253.3	0.286	-		101.3	0.122	-
	278.6	0.304	-		121.6	-	0.974
	283.7	-	0.9929		126.7	0.148	-
348.15	1.0	0.00135	-		152.0	0.174	0.976
	50.7	0.067	-		177.3	0.198	-
	76.0	0.097	-		202.6	0.223	0.979
	101.5	0.126	-		228.0	0.246	-
	121.6	-	0.986		243.2	-	0.978
	126.7	0.153	-		253.3	0.268	-
	152.0	0.180	-		278.6	0.288	-

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Equilibrium vessel made of beryllium copper of 2 × 10^5 mm^3 capacity attached to small sampling vessel. Pressure measured with Bourdon gauge. Magnetic stirrer in equilibrium vessel. Solvent introduced into equilibrium vessel, compressed gas admitted and equilibrated. Samples analysed by gravimetric (liquid) and volumetric (gas) techniques. Details in ref. 1.

SOURCE AND PURITY OF MATERIALS:

1. Commercial sample, 99.9 mole per cent purity.

2. Distilled and dried.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta P/bar = \pm 0.5$;
$\delta x_{Ar} = \pm 1\%$; $\delta y_{Ar} \approx 0.1\%$.

REFERENCES:

1. Graham, E. B., *Ph.D. Thesis, University of London*, 1958.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Tributyl phosphate; $C_{12}H_{27}O_4P$; 126-73-8

ORIGINAL MEASUREMENTS:

Shakhova, S. F. and Zubchenko, Yu. P., *Khim. Prom.*, 1973, *49*, 595.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	α† vol/vol	T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	α† vol/vol
298.15	32.63	0.0631	5.8	323.15	86.33	0.1424	14.3
	50.05	0.0956	9.1		86.84	0.1432	14.4
	52.99	0.0975	9.3		91.19	0.1517	15.4
	55.42	0.0975	9.3		95.35	0.1558	15.9
	67.58	0.1151	11.2		102.54	0.1657	17.1
	69.71	0.1205	11.8		108.11	0.1737	18.1
	77.61	0.1311	13.0		112.27	0.1823	19.2
	79.44	0.1338	13.3		113.79	0.1792	18.8
	96.16	0.1567	16.0		133.75	0.2079	22.6
	98.89	0.1591	16.3	343.15	45.09	0.0830	7.8
	122.80	0.1953	20.9		65.53	0.1105	10.7
	129.59	0.2020	21.8		79.24	0.1329	13.2
323.15	45.60	0.0830	7.8		97.27	0.1608	16.5
	61.81	0.1114	10.8		118.25	0.1854	19.6
	69.91	0.1205	11.8		135.57	0.2079	22.6
	71.64	0.1294	12.8				

α† quoted in original paper, appears to be volume of gas at T/K = 273.15 and P = 1 atmosphere adsorbed by unit volume of liquid at room temperature.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Mixture stirred by ball in rocking autoclave. Samples of liquid analysed by volumetric method. Details in ref. 1.

SOURCE AND PURITY OF MATERIALS:

1. Purity 99.9 mole per cent.
2. No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta P/\text{bar} = \pm 0.1$;

$\delta x_{Ar} = \pm 5\%$ (estimated by compiler).

REFERENCES:

1. Shakhova, S. F., Zubchenko. Yu. P., and Kaplan, L. K., *Khim. Prom.*, 1973, *5*, 108.

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. 2-Pyrrolidinone,1,5-dimethyl- (N-methyl-2-pyrrolodinone); C_5H_9NO; 5075-92-3

ORIGINAL MEASUREMENTS:

Shakhova, S. F. and Zubchenko, Yu. P., *Khim. Prom.*, 1973, *49*, 595.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	α† vol/vol	T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	α† vol/vol
298.15	35.36	0.0132	3.1	323.15	116.22	0.0402	9.7
	50.76	0.0182	4.3	343.15	34.35	0.0145	3.4
	82.38	0.0281	6.7		50.05	0.0203	4.8
	109.33	0.0362	8.7		72.14	0.0285	6.8
323.15	34.55	0.0136	3.2		92.41	0.0350	8.4
	51.98	0.0199	4.7		105.99	0.0398	9.6
	74.07	0.0281	6.7		120.48	0.0449	10.9
	89.77	0.0325	7.8				

α† quoted in original paper, appears to be volume of gas at T/K = 273.15 and P = 1 atmosphere adsorbed by unit volume of liquid at room temperature.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Mixture stirred by ball in rocking autoclave. Samples of liquid analysed by volumetric method. Details in source and ref. 1.

SOURCE AND PURITY OF MATERIALS:

1. Purity 99.9 mole per cent.
2. No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta P/bar = \pm 0.1$;

$\delta x_{Ar} = \pm 5\%$ (estimated by compiler).

REFERENCES:

1. Shakhova, S. F., Zubchenko, Yu. P. and Kaplan, L. K., *Khim. Prom.*, 1973, *5*, 108.

COMPONENTS:

1. Argon; Ar; [7440-37-1]
2. Methane; CH_4; [74-82-8]
3. Nitrogen; N_2; [7727-37-9]

ORIGINAL MEASUREMENTS:

Miller, R. C.; Kidnay, A. J.;
Hiza, M. J. *Am. Inst. Chem. Engnrs. J.* <u>1973</u>, *19*, 145.

VARIABLES:

Pressure, composition

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar			Mole fractions			
			in liquid			in vapor	
		x_{Ar}	x_{N_2}	x_{CH_4}	y_{Ar}	y_{N_2}	y_{CH_4}
112.00	4.500	-	-	-	0.8535	0.0060	0.1405
	4.452	0.4946	0.0015	0.5040	-	-	-
	5.088	0.4841	0.0422	0.4738	0.7232	0.1531	0.1236
	7.060	0.4181	0.1876	0.3943	0.4548	0.4609	0.0843
	9.100	0.3382	0.3595	0.3024	0.2950	0.6455	0.0594
	11.100	0.2530	0.5380	0.2090	0.1900	0.7691	0.0408
	13.169	0.1585	0.7234	0.1181	0.1077	0.8672	0.0251
	6.880	0.8837	0.0011	0.1151	0.9724	0.0021	0.0255
	7.460	0.8462	0.0574	0.0962	0.8522	0.1248	0.0229
	9.100	0.7031	0.2180	0.0789	0.6025	0.3802	0.0173
	11.148	0.5094	0.4341	0.0566	0.3797	0.6084	0.0119
	13.115	0.3119	0.6546	0.0334	0.2155	0.7765	0.0080
	1.752	0.0944	0.0016	0.9039	0.4297	0.0172	0.5531
	3.055	0.0831	0.0612	0.8558	0.2276	0.4590	0.3134
	5.613	0.6895	0.0017	0.3089	0.9165	0.0052	0.0782
	9.090	0.4959	0.3003	0.2038	0.4260	0.5313	0.0427
	11.165	0.3578	0.5024	0.1397	0.2663	0.7040	0.0296
	13.142	0.2251	0.6916	0.0834	0.1520	0.8299	0.0181
	3.209	0.3081	0.0000	0.6919	0.7629	0.0002	0.2369
	5.162	0.2795	0.1144	0.6061	0.4218	0.4315	0.1466
	7.174	0.2387	0.2543	0.5071	0.2510	0.6552	0.0937
	9.095	0.1880	0.4156	0.3964	0.1644	0.7592	0.0764
	11.190	0.1372	0.5960	0.2667	0.0998	0.8508	0.0494

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Recirculating vapor-flow apparatus. Temperature measured with platinum resistance thermometer. Pressure measured with Bourdon gauge. Gas and liquid samples analysed by gas chromatography. Details in source and refs. 1 and 2.

SOURCE AND PURITY OF MATERIALS:

No details given

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta P/\text{bar} = \pm 0.02$;

δx, δy = ±1%.

REFERENCES:

1. Kidnay, A. J.; Miller, R. C.; Hiza, M. J. *Ind. Eng. Chem. Fund.* <u>1971</u>, *10*, 459.
2. Miller, R. C.; Kidnay, A. J.; Hiza, M. J. *J. Chem. Thermodynamics* <u>1972</u>, *4*, 807.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Argon; Ar; [7440-37-1] 2. Methane; CH_4; [74-82-8] 3. Nitrogen; N_2; [7727-37-9]	Miller, R. C.; Kidnay, A. J.; Hiza, M. J. *Am. Inst. Chem. Engnrs. J.* 1973, *19*, 145.

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fractions in liquid x_{Ar}	x_{N_2}	x_{CH_4}	in vapor y_{Ar}	y_{N_2}	y_{CH_4}
112.00	13.140	0.0878	0.7595	0.1527	0.0384	0.9408	0.0208
	1.542	-	-	-	0.3588	0.0040	0.6372
	1.545	0.0690	0.0003	0.9307	-	-	-
	3.135	-	-	-	0.7377	0.0029	0.2594
	3.143	0.2945	0.0005	0.7049	-	-	-

COMPONENTS:

1. Argon; Ar; [7440-37-1]
2. Ammonia; NH_3; [7664-41-7]

EVALUATOR:

Colin L. Young,
School of Chemistry,
University of Melbourne,
Parkville, Victoria 3052,
AUSTRALIA.

July, 1978

CRITICAL EVALUATION:

This system has been studied in some detail at high pressure, but some of the studies have been undertaken to establish details of gas-gas equilibria rather than conventional high pressure solubility. Tsiklis and Vasil'ev (1) have made a detailed study of phase equilibria in this system up to pressures of 10^4 bar, bur report their data only in small graphical form. Their work is not considered further. Kaminishi (2) has reported measurements at 273.15 K to 323.15 K up to 200 bar. Michels *et al.* (3) reported measurements between 298.15 K and 373.15 K at pressures up to 825 bar and Matous *et al.* (4) presented data between 243.15 K and 303.15 K at 277 and 47.1 bar.

There is good agreement in the overlapping ranges of these three latter studies. The limited data of Heise (5) is also in fair agreement with values obtained by extrapolation of the above studies. All four sets of data (2,3,4,5) are classified as tentative. It is not possible to give a stronger recommendation in view of the limited overlap in the ranges of temperature and pressure.

The results of Cseko and Corrides (6,7) have been rejected, since while the quoted reproducibility is better than 1%, their publication omits the temperature to which these data refer, but it may be inferred from the original publication that the measurements were carried out at room temperature. The solubility is constant to within 10% over between 15 °C and 25 °C.

The data of Zeininger (8) is also rejected as the reported solubility is slightly smaller than that of other workers and is presented in graphical form.

References

1. Tsiklis, D. S.; Vasil'ev, Yu. N. *Zhur. Fiz. Khim.* 1955, *29*, 1530.
2. Kaminishi, G. *Kogyo Kaguka Zasshi* 1965, *68*, 419 (*Int. Chem. Eng.* 1965 *5*, 749. English translation).
3. Michels, A.; Dumoulin, E.; Van Dyk, J. J. Th. *Physica* 1961, *27*, 886.
4. Matous, J.; Sobr.; Novak, J. P. *Coll. Czech. Chem. Comm.* 1970, *35*, 3757.
5. Heise, F. *Ber. Bunsenges Phys. Chem.* 1972, *76*, 936.
6. Cseko, Gy. *Magyar Kem. Folyoirat* 1961, *67*, 306.
7. Cseko, Gy.; Cornides, I. *J. Inorg. Nuclear Chem.* 1960, *14*, 139.
8. Zeininger, H. *Chem.-Ing.-Tech.* 1973 *45*, 1067.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Ammonia; NH_3; 7664-41-7

ORIGINAL MEASUREMENTS:

Michels, A., Dumoulin, E. and Van Dijk, J. J., *Physica*, 1961, *27*, 886.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	in gas, y_{Ar}
298.48	25.447	0.00307	0.5677
	50.741	0.0078	0.7555
	76.091	0.0119	0.8233
	101.396	0.0161	0.8551
	202.175	0.0291	0.8941
	304.706	0.0391	0.9085
	404.823	0.0474	0.9166
	506.832	0.0534	0.9205
	608.589	0.0569	0.9177
	710.464	0.0597	0.9216
	812.401	0.0627	0.9254
322.93	25.253	0.00146	0.1834
	50.741	0.00723	0.5347
	101.420	0.0201	0.7217
	202.175	0.0427	0.8021
	304.792	0.0628	0.8201
	405.377	0.0784	0.8245
	555.700	0.0958	0.8239
	710.464	0.1079	0.8306
322.93	812.401	0.1129	0.8362
348.07	50.741	0.00485	0.2079
	76.081	0.0138	0.3994
	101.396	0.0228	0.4986
	202.175	0.0604	0.6399
	304.792	0.1002	0.6606
	405.377	0.1405	0.6493
	506.040	0.1821	0.6236
	608.746	0.2271	0.5892
	710.464	0.2753	0.5469
	759.427	0.3049	0.5250
	812.404	0.3390	0.4950
	823.861	0.3418	0.4938
373.75	101.420	0.0205	0.2497
	202.175	0.0841	0.4182
	253.678	0.1312	0.4084
	278.32	0.1652	0.3859
	288.43	0.1866	0.3649
	296.51	0.2144	0.3402

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Ammonia added to equilibrium cell; argon passed through liquid ammonia for several days. Samples of gas and liquid analysed at atmospheric pressure by adsorbing ammonia in sulphuric acid. Details in source and ref. 1.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta P/\mathrm{bar} = \pm 0.005$;

δx_{Ar}, δy_{Ar} = ±0.5% (estimated by compiler).

REFERENCES:

1. Michels, A., Skelton, G. F. and Dumoulin, E., *Physica*, 1950, *16*, 831.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Argon; Ar; [7440-37-1] 2. Ammonia; NH_3; [7664-41-7]	Kaminishi, G., *Kogyo Kogaku Zaashi*, 1965, *68*, 419.
VARIABLES: Temperature, pressure	**PREPARED BY:** C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid x_{Ar}
273.15	50.8	0.00561
	101.8	0.01084
	150.9	0.01509
	199.9	0.01845
298.15	50.8	0.00717
	101.8	0.01535
	150.9	0.02245
	199.9	0.02859
323.15	50.8	0.00800
	101.8	0.01981
	150.9	0.03128
	199.9	0.04145

AUXILIARY INFORMATION

METHOD/PROCEDURE/APPARATUS:

Static equilibrium cell with agitator. Pressure measured with Bourdon gauge. Liquid ammonia placed in cell and then argon pressurized into cell. After equilibrium established liquid sample removed and analysed by volumetric and gravimetric techniques. Details in source.

SOURCE AND PURITY OF MATERIALS:

1. Tokai Ammonia Sulfate Co. sample purity 99.99 mole per cent.
2. Distilled four times, no other details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta P/\text{bar} = \pm 0.1$;

$\delta x_{Ar} = \pm 1\%$ (estimated by compiler).

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Ammonia; NH_3; 7664-41-7

ORIGINAL MEASUREMENTS:

Matous, J., Sobr, J. and Novak, J. P., *Coll. Czech. Chem. Comm.*, 1970, *35*, 3757.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}
243.15	27.7	0.0238
253.15	27.7	0.0274
263.15	27.7	0.0295
273.15	27.7	0.0309
283.15	27.7	0.0324
293.15	27.7	0.0334
303.15	27.7	0.0316
243.15	47.1	0.0356
253.15	47.1	0.0416
263.15	47.1	0.0491
273.15	47.1	0.0533
283.15	47.1	0.0573
293.15	47.1	0.0614
303.15	47.1	0.0674

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Rocking autoclave apparatus. Cell charged with components equilibrated and pressure measured with Bourdon gauge. Liquid phase sample added to sulfate buffer solution and gaseous argon estimated volumetrically.

SOURCE AND PURITY OF MATERIALS:

1. MCHZ-Ostrava sample purity better than 99.99 mole per cent.

2. MCHZ-Ostrava sample purity better than 99.99 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta P/\text{bar} = \pm 0.5$;

$\delta x_{Ar} < \pm 2\%$.

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1
2. Ammonia; NH_3; 7664-41-7

ORIGINAL MEASUREMENTS:

Heise, F., *Ber. Bunsenges. Phys. Chem.*, 1972, *76*, 936.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	in vapor, y_{Ar}
298.15	105.05	0.01664	0.9045
	212.05	0.03120	0.8613
313.15	104.55	0.01957	0.7936
	204.1	0.03835	0.8470

AUXILIARY INFORMATION

METHOD/ APPARATUS/PROCEDURE:

Static rocking equilibrium cell. Liquid and gas samples removed after equilibrium established. Samples analysed by freezing out ammonia in liquid nitrogen trap. Details in source and ref. 1.

SOURCE AND PURITY OF MATERIALS:

1. Messer-Griesheim sample, purity better than 99.95 mole per cent.
2. Gerling and Holtz sample, purity better than 99.8 mole per cent as determined by gas chromatography and mass spectrometry.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta P/\text{bar} = \pm 0.3$ below 100 bar; ± 0.6 above 100 bar; $\delta x_{Ar} = \pm 2\%$ (estimated by compiler).

REFERENCES:

1. Heise, F., *Dissertation*, Göttingen, 1971.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Carbon monoxide; CO; 630-08-0

ORIGINAL MEASUREMENTS:

Christiansen, L. J., Fredenslund, A. and Mollerup, J., *Cryogenics*, 1973, *13*, 405.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of carbon monoxide in liquid, x_{CO}	in gas, y_{CO}
123.4	15.21	0.0790	0.1040
	16.40	0.1990	0.2450
	17.80	0.3490	0.4060
	18.89	0.4830	0.5450
	19.88	0.6290	0.6770
	20.61	0.7470	0.7810
	20.76	0.7690	0.8000
	21.54	0.8800	0.8980
	21.98	0.9380	0.9470
137.1	29.19	0.0860	0.1000
	30.79	0.1940	0.2150
	31.78	0.2460	0.2690
	33.29	0.3390	0.3670
	34.69	0.4280	0.4530
	36.41	0.5600	0.5710
	37.77	0.6600	0.6700

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Recirculating vapor flow apparatus. Temperature measured with platinum resistance thermometer; pressure measured with dead weight piston gauge. Coexisting samples analysed by gas chromatography. Details in ref. 1.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.01$; $\delta P/\text{bar} = \pm 0.01$;

$\delta x_{CO} = \pm 0.004$; $\delta y_{CO} = \pm 0.003$

(estimated by compiler).

REFERENCES:

1. Fredenslund, A., Mollerup, J. and Christiansen, L. J., *Cryogenics*, 1973, *13*, 414.

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Carbon dioxide; CO_2; 124-38-9

ORIGINAL MEASUREMENTS:

Kaminishi, G., Arai, Y., Saito, S. and Maeda, S., *J. Chem. Engng. Japan*, 1968, *1*, 109.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}	in gas, y_{Ar}
233.15	25.7	-	0.552
	43.8	-	0.683
	61.4	0.120	0.734
	98.8	0.216	0.754
	132.3	0.350	0.706
253.15	43.8	0.053	0.454
	61.4	0.095	0.548
	98.8	0.205	0.613
	122.6	0.295	0.582
	130.3	-	0.548
273.15	43.8	-	0.149
	49.7	0.033	0.211
	61.4	0.061	0.301
	79.2	0.106	0.383
	98.8	0.171	0.411
	108.6	0.214	0.396
	114.2	0.252	0.378
	116.3	0.282	0.352
	116.7	0.310	0.324

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Static cell fitted with magnetic stirrer. Temperature measured with liquid in glass thermometer and pressure measured with Bourdon gauge. After equilibrium established vapor and liquid samples analysed by a volumetric technique. Carbon dioxide was absorbed in potassium hydroxide solution.

SOURCE AND PURITY OF MATERIALS:

1. Nippon Sanso Industry Co. sample, purity 99.99 mole per cent.
2. No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta P/\text{bar} = \pm 0.1$;

δx_{Ar}, $\delta y_{Ar} = \pm 1\%$ (estimated by compiler).

REFERENCES:

COMPONENTS:

1. Argon; Ar; 7440-37-1

2. Carbon dioxide; CO_2; 124-38-9

ORIGINAL MEASUREMENTS:

Sarashina, E., Arai, Y. and Saito, S., *J. Chem. Engng. Japan*, 1971, *4*, 379.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of argon in liquid, x_{Ar}
288.15	75.1	0.060
	87.5	0.100
	94.6	0.134
	97.8	0.167

Dew point data also given in source.

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Dew point-bubble point glass cell. Glass capillary cell fitted with magnetic stirrer. Pressure measured with a dead weight gauge. Temperature measured with mercury in glass thermometer. Mixtures of known composition charged into cell. Bubble point determined from plots of volume against pressure. Dew point determined visually. Details in ref. 1.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.01$; $\delta P/\text{bar} = \pm 0.1$; $\delta x_{Ar} = \pm 1\%$.

REFERENCES:

1. Yasuhiko, A., Kaminishi, G. and Saito, S., *J. Chem. Engng. Japan*, 1971, *4*, 113.

SYSTEM INDEX

Underlined page numbers refer to evaluation text and those not underlined to compiled tables. The compounds are listed in the order as in the Chemical Abstracts indexes. For example, toluene is listed as benzene, methyl-, and dimethylsulfoxide is listed as methane, sulfinylbis-. Many other names are cross-referenced to the name as used in the Chemical Abstracts Chemical Substance index.

REGISTRY NUMBER INDEX

Underlined page numbers refer to evaluation text and those not underlined to compiled tables.